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PROJECT NO. 2235

AIR-TO-GROUND VISUAL SIMULATION DEMONSTRATION

FINAL REPORT

VOLUME 2 OF 2

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PREFACE

Project 2235 was structured in three phases. Phase I was the technical evaluation phase, Phase II was the reporting phase. The report documents project activities and results in two volumes. Volume I documents Phase III, the reporting phase. It contains an executive summary, results of Phase I and II, and an analysis of those results, conclusions and recommendations. This volume documents the detailed procedures and methods used during Phase I and II. Engineering data obtained during Phase I is also contained in this volume.

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ILLUSTRATIONS

TERMS AND ABBREVIATIONS

AOI	Area of Interest
APL	Average Picture Level
ASUPT	Advanced Simulator for Undergraduate Pilot Training
CCTV	Closed Circuit Television
CIG	Computer Image Generation, also termed CGI
CRT	Cathode Ray Tube
fl	Foot lambert
GE	General Electric
LAMARS	Large Amplitude Multi Mode Airspace Research Simulator
MTF	Modulation Transfer Function
SAAC	Simulator for Air-to-Air Combat
SEL	System Engineering Laboratories
STG	Synthetic Terrain Generator
TMB	Terrain Model Board
TV	Television

GLOSSARY

Area of Interest - A segment of a visual display nor-lly square or rectangular, which contains a high resolution terrain video presentation of some feature, such as terrain or airborne targets. The remainder of the display can be low resolution supporting information such as featureless sky/earth or sky/checkerboard patterns.

Brightness - Measurement of the amount of light emitted from the CRT Face or the available light displayed after passing through the opitical chain. Expressed in foot lamberts.

Collimation Errors - Errors which cause objects to appear nearer or farther than infinity when viewed through infinity (virtual image) optics display packages.

Contrast - The ratio between the brightness of the brightest highlight in a display and that of the dimmest gray shade. Shading effects should be accounted for or eliminated when measuring contrast.

Edge - The straight line segment between two vertices.

Field of View - Total display surface available for pilot viewing. Expressed in angular measures, i.e., ± degress horizontal and vertical, from the X axis of the aircraft.

Gray Scale - A series of gray patches increasing in brightness from black to white difference between any two patches.

Gray Shade - One of the 1024 levels of brightness available on a CRT.

Limiting Resolution - That spatial frequency on a resolution wedge beyond which the individual resolution lines are not visible. This point on a resolution wedge is very indefinite and subject to wide variation among different observers. A more consistent figure for limiting resolution is obtained by specifying the spatial frequency beyond which the MTF curve drops below a given value, usually 5%.

Line Pair - A pair of adjacent black and white lines. This term is used in optical rather than video systems.

Linear Gray Scale - A series of gray patches which has a constant brightness difference between any two adjacent patches. The logarithmic response of the human eye makes the lighter shades of linear gray scale appear much closer together than the darker shades.

Logarithmic Gray Scale - A series of gray patches which has a constant brightness ratio between any two adjacent patches.

Modulation Transfer Function (MTF) - A spatial frequency response curve for electro-optical systems.

Optical Mosaic - System which incorporates more than one CRT to expand the field of view. CRTs are normally situated in such a way so as to have no gaps between CRT joints. (Juxtaposed.)

Perspective - The ability of visual systems to present depth and distance cues.

Raster - The left to right, top to bottom pattern of the CRT Electron Beam. Modulation of the beam by video signal causes activation of CRT faceplate phosphor resulting in recognizable images being generated.

Resolution - Term used to express the ability of a system (generation or display) to faithfully reproduce an image.

Resolution Wedge - A collection of alternating black and white lines (usually four flack and three white) which decrease in width from one end to the other thus forming a wedge. The line width at any point on the wedge is usually marked to show how many lines of that width (counting both black and white) would fit into a distance equal to the TV raster height.

Scan Line - One line of the raster, left to right.

Shading - Variation in brightness over the surface of a display when the original scene is of even brightness. Displays are typically less bright at their corners and edges than they are at the center.

Spatial Frequency - The number of TV lines per some unit distance or per unit viewing angle. These measures may be inverted to show the distance per single TV line or the viewing angle per single TV line.

TV Line - One line of a resolution wedge (black or white).

SECTION I

PHASE I DATA

1. INTRODUCTION

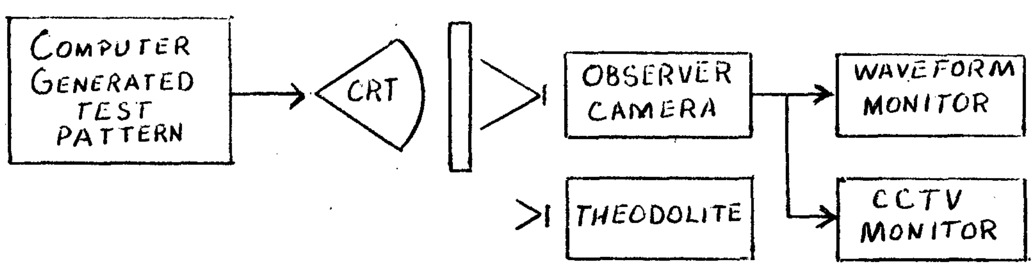
The following information documents the Phase I evaluation. The information is organized by system (i.e., CIG/Optical Mosaic, TMB/Dome Projection and TMB/Optical Mosaic). The test methods for each system are immediately followed by the results.

2. CIG/OPTICAL MOSAIC SYSTEM

a. System Static Resolution/Modulation Transfer Function (MTF)

(1) Test Method with Observer Camera

A test pattern shall be generated by the system image generator consisting of alternating black and white stripes on a 32% gray terrain background. There shall be four black stripes and three white stripes ordered as follows: 20 ft black, 10 ft white, 10 ft black, 10 ft white, 10 ft black, 10 ft white, and 20 ft black. All stripes shall be 100 feet long. Modulation depth as a function of angular resolution shall be measured at the pilot's eyepoint using the observer camera technique. Angular resolution shall be controlled by varying the simulated altitude. Angular resolution shall be checked for at least one altitude by measuring it with a theodolite at the pilot's eyepoint.



(2) Data Required

(a) Horizontal MTF (along scan line if scan line is not horizontal) at forward window center from 1° to 2' angular resolution per line. (Simulated altitude 573 feet to 17189 feet).

(b) Repeat (a) at one corner of the forward window.

(c) Rotate pattern so stripes are parallel to scan lines; measure vertical MTF at forward window center from 1° to 2' angular resolution.

(d) Repeat (c) at one corner of the forward window.

(e) Repeat (a) through (d) on a second window.

(3) Equipment Required

(a) Modified Diamond Observer Camera.

(b) Kern DKM1 Theodolite.

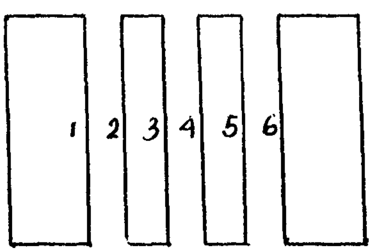
(c) Waveform Monitor.

(d) CCTV Monitor for 525/60 video output of the observer camera.

(e) Software to generate resolution test pattern.

b. <u>System Static Resolution Results</u>

Initially the resolution pattern was presented at a simulated altitude of 573 feet at which time each 10 foot wide stripe should substend 1. This was checked with the theodolite with the following results:



Point	Azimuth
1	176° 42'
2	177° 48'
3	178° 44'
4	179° 50'
5	180° 44'
6	181° 49'

(elevation fixed at 90°)

The total angle from point 1 to point 6 was 5° 7'. Allowing for the 15° slope of the scan lines in window 1, the horizontal angle subtended by the five stripes should be 5° 10' ($5^{\circ}/\cos 15^{\circ}$). Thus, the measured angle was within about 1% of the calculated value. This is well within the tolerances of the display and measurement methods, and it was assumed that the proper resolution would be displayed for all precalculated altitudes.

Horizontal MTF at center of window 1. (Actual point of measurement was about half way between window center and the simulator axis because of hardware obstructions).

Resolution	Percent Modulation
1°	100
30'	100
15'	60
8'	20
4'	5%

Horizontal MTF at corner of window 1. (Near intersection with windows 2 and 4).

Resolution	Percent Modulation
1°	100
30'	95
15'	60
8'	15
4'	--

Vertical MTF at center of window 1.

Resolution	Percent Modulation
1°	100
30'	100
15'	100
8'	quantization problems: grouped 2 stripes for 95%, single stripe 55%.
4'	2 stripes missing

Vertical MTF at corner of window 1.

Resolution	Percent Modulation
1°	100
30'	100
15'	80
8'	80
4'	Double 80, single 50, 1 line missing

Horizontal MTF at center of window 4.

Resolution	Percent Modulation
1°	100
30'	100
15'	50
8'	15
4'	5

Horizontal MTF at corner of window 4 (intersection with windows 2 and 6).

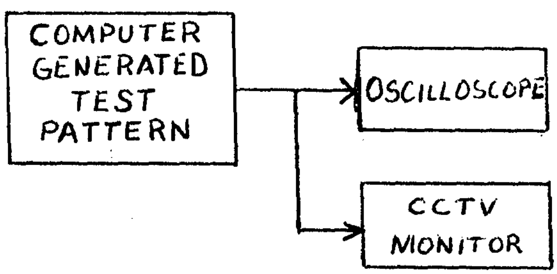
Resolution	Percent Modulation
1°	100
30'	85
15'	60
8'	20
4'	

Vertical MTF at corner of second window. No measurement taken due to shortness of time and great difficulty of properly positioning display. We felt that data on hand was adequate and representative.

c. <u>Image Generator Static Resolution/MTF</u>

(1) Test Method: Video Signal Analysis

Modulation depth (as a function of angular resolution at the display) shall be measure through analysis of the video signal at the point where the video enters the display.



(2) Data Required

Horizontal MTF at forward window center from 1° to2' angular resolution. This data will be collected simultaneously with test I.C.1.

(3) Equipment Required

(a) Tektronix 485 or 7904 Oscilloscope.

(b) CCTV monitor for 1023/60 video of ASUPT.

(c) Software as in test I.

d. <u>Image Generator Static Resolution/MTF Results</u>

Horizontal MTF of video for center of window 1.

Resolution	Video Amplitude
1°	1.8 V
30'	1.8 V
15'	1.7 V
8'	.95 V
4'	.5 V
2'	0

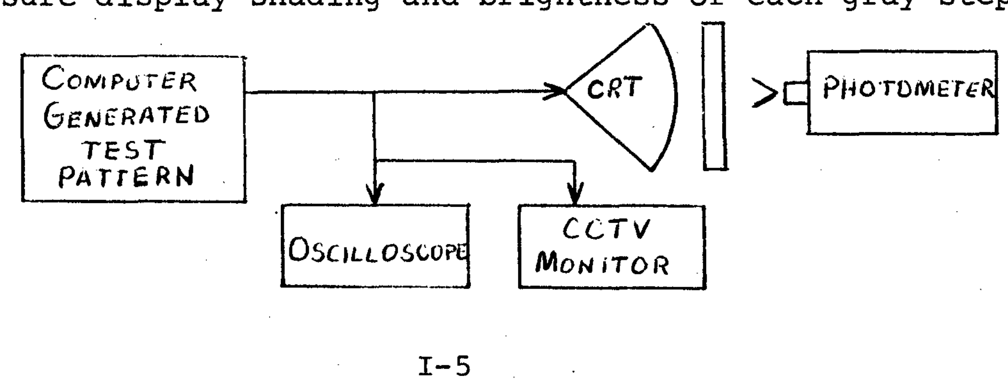
Readings were taken on a Tektronix 485 at .5V/div.

NOTE: An earlier planned test of display MTF using a pattern generator was eliminated on the assumption that signals from the ASUPT image generator would be very much like those from an external pattern generator. Instead the edge smoothing utilized in the image generator reduced the peak-to-peak signal amplitude at smaller resolution angles.

e. <u>Display Brightness, Gray Scale, Contrast, Shading</u>

(1) Test Method: Photometer

A test pattern shall be displayed which includes a gray scale spanning from video black to peak white. The pattern shall be formed by simulating a terrain with 10 fields, each 16 feet by 16 feet. The shades of the fields shall be 10 evenly spaced shades selected from the 64 available: 0, 7, 14, 21, 28, 35, 42, 49, 56, and 63. The video shall have a 32% gray background. A photometer shall be located at the pilot's eyepoint and be used to measure display shading and brightness of each gray step.



(2) Data Required

(a) With 32% gray over the entire display, measure picture brightness at the center and each corner of the forward window and one other window.

(b) Measure brightness of each step of the gray scale at the center and one corner of the forward window. Keep the photometer fixed and slew the display by varying the simulated aircraft position.

(c) Simultaneously with step (b) measure video amplitude for each step of the gray scale at the point where the video enters the display.

(d) Repeat test (c) on a second window.

(3) Equipment Required

(a) Gamma Scientific Digital Photometer.

(b) Tektronix 484 or 7904 Oscilloscope.

(c) CCTV monitor for 1023/60 video of ASUPT.

f. <u>Display Brightness, Gray Scale, Contrast, Shading Results</u>

(1) Shading measurements were taken on the step 32 (50% APL) background of the gray scale pattern provided by AFHRL/FT. All readings in footlamberts.

Window 1

Center	2.9
Right edge	3.2
Bottom right	1.9
Bottom center	3.3
Bottom left	3.3
Left edge	2.9

Window 4

Center	2.7
Upper right	2.5
Upper Middle	3.3
Left edge	2.0
Bottom edge	3.0
Near left corner	2.5

(2) Brightness of gray scale steps was measured only at the center of two windows and by reaiming the photometer rather than slewing the display. ASUPT personnel were having great difficulty positioning the display by flying an aircraft with zero velocity

		Window #1	Window #4
Step 1	(black, 0)	.85	.6
2	(7)	1.2	1.0
3	(14)	1.6	1.4
4	(21)	2.2	2.1
5	(28)	2.9	2.6
6	(35)	3.2	3.0
7	(42)	4.0	3.4
8	(49)	4.3	4.5
9	(56)	5.0	5.1
10	(white, 63)	5.9	5.8

Readings were taken with only window 1 operating. Although the gray scale had a satisfactory visual appearance, it was obvious that the gray scale readings, especially on the black end, were being skewed by the manner of presentation or by the manner of reading. For comparison, we took a set of readings on the diagnostic gray scale which is available in the system. The diagnostic gray scale presents each step individually on a black background.

Diagnostic		Brightness
11	(black)	.08
1		.20
2		.24
3		.32
4		.50
5		.85
6		1.2
7		1.7
8		2.5
9		3.6
10	(white)	5.5 - 6.1

While measuring white, the photometer indicator varied from 5.5 to 6.1 with no changes being made to the system or the photometer (Spectra model UB, $\frac{1}{4}^{\circ}$).

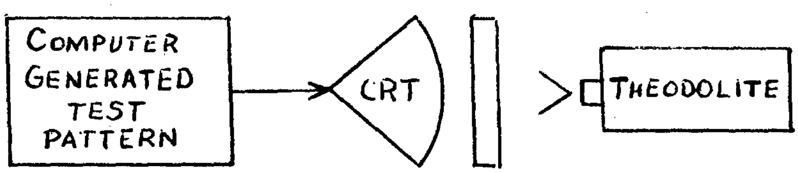
(3) Brightness of gray scale at center of window 4. Again, the photometer was slewed rather than the display.

Step	Brightness
1 (black)	.6
2	1.0
3	1.4
4	2.1
5	2.6
6	3.0
7	3.4
8	4.5
9	5.1
10 (white)	5.8

g. <u>System Geometric Distortion</u>

(1) Test Method: Theodolite

A linearity test pattern shall be generated by the system image generator. A theodolite shall be located at the pilot's eyepoint and be used to measure angles in the display for comparison with the pre-computed values.



(2) Data Required

Measure angles to about 30 of the intersections of a checkerboard pattern presented in the forward window.

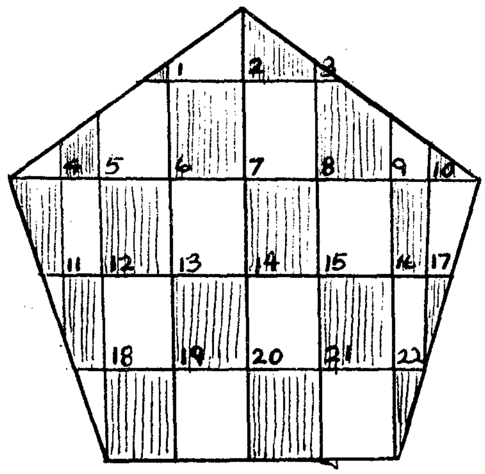
(3) Equipment Required

(a) Kern DKM1 Theodolite.

(b) Software to generate checkerboard test pattern.

h. System Geometric Distortion Results

We started with the diagnostic checkerboard and with the theodolite only approximately located at the pilot's eyepoint. This display has 22 intersections which we numbered as follows:



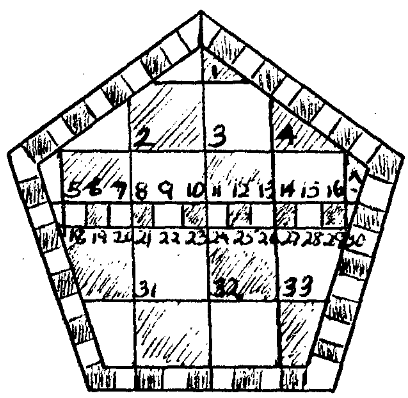
Point	Az	El
1	326° 45'	122° 21'
2	339° 49'	125° 33'
3	353° 52'	127° 27'
4	313° 15'	103° 40'
5	319° 39'	106° 01'
6	330° 27'	112° 28'
7	343° 27'	109° 26'
8	356° 59'	114° 42'
9	8° 48'	115° 48'
10	15° 49'	115° 57'
11	316° 06'	92° 23'
18	326° 45'	78° 32'
19	337° 26'	80° 23'
20	349° 37'	82° 59'
21	1° 46'	85° 44'
22	12° 05'	88° 04'

Points 12-17 blocked by hardware

Diagnostic checkerboard in window 2.

Point	Az	El
4	240° 01'	131° 41'
5	247° 21'	135° 51'
6	261° 09'	141° 10'
7	281° 11'	144° 20'
8	302° 58'	144° 27'
9	320° 03'	141° 39'
10	329° 02'	138° 53'
11	247° 04'	121° 53'
12	254° 30'	125° 00'
13	267° 23'	128° 56'
14	284° 11'	131° 38'
15	301° 30'	131° 56'
16	323° 50'	128° 14'

We then switched to the dodecahedron display and had the theodolite precisely aligned by contractor maintenance personnel. One window with all detail present is pictured in the diagram below.



Point	Az	El
1	164° 23'	125° 59'
2	152° 42'	109° 47'
12	175° 05'	104° 50'
13	180° 14'	105° 47'
14	185° 23'	106° 30'
15	190° 12	107° 13'
16	194° 49'	107° 44'
17	199° 03'	108° 02'
21	156° 07'	95° 59'
22	160° 58'	97° 06'
23	166° 01'	98° 09'
24	170° 51'	99° 09'
25	176° 06'	100° 10'
26	181° 05'	101° 00'
27	186° 05'	101° 51'
28	190° 46'	102° 32'
29	195° 26'	103° 12'
30	199° 22'	103° 43'
31	159° 14'	82° 06'
32	173° 39'	84° 57'
33	187° 57'	87° 59'

i. System Interwindow Continuity

(1) Test Method: Theodolite

A full display linearity test pattern shall be generated by the system image generator. A theodolite shall be located at the pilot's eyepoint and shall be used to measure discontinuity across the window joints.

Block Diagram
Same as in paragraph f.

(2) Data Required

Measure angles at selected points along each side of three window joints.

(3) Equipment Required

(a) Kern DKM1 Theodolite.

(b) Software to generate interwindow test pattern.

j. System Interwindow Continuity Results

Each edge of the dodecahedron has 9 intersections of the small checks along the edge of each face. Ideally, all of these intersections should be hidden behind the window joints when the dodecahedron is viewed from the pilots nominal eyepoint. If the viewer moves his head back and forth in order to see around the joints, there should be no apparent displacement of the intersection as it is viewed from one window or the other. In reality, the two images of the same intersection as viewed through two adjacent windows may be displaced from each other in any direction. As it happened for our tests on ASUPT, the displacements along the joints we were interested in (the intersections of windows 1, 2, and 4) were all such that a given point appeared simultaneously in both adjacent windows. Thus, the discontinuity was simply a measure of the angular difference between the two apparent locations. Numbering from window 2 along the joint between windows 1 and 4, the checkboard intersections were located as follows:

Point	Window 1		Window 4	
	Az	El	Az	El
7	147° 49'	75° 49'	148° 03'	74° 44'
8	150° 13'	72° 06'	150° 30'	71° 08'

Numbering from window 1 along the joint between windows 2 and 4.

Point	Window 1		Window 4	
	Az	El	Az	El
2	125° 06'	100° 41'	125° 46'	100° 18'
4	116° 10'	100° 09'	116° 58'	99° 50'
6	107° 00'	99° 17'	107° 35'	98° 56'
7	102° 31'	98° 40'	103° 05'	98° 25'

Numbering from window 4 along the joint between windows 1 and 2.

Point	Window 1 Az	Window 1 El	Window 2 Az	Window 2 El
1	135° 14'	104° 28'	134° 46'	104° 18'
4	142° 23'	115° 13'	141° 29'	114° 59'
6	147° 50'	122° 33'	146° 54'	122° 33'

After we had obtained the above data, GE personnel discovered that some constants in the data base were not the same as those used during the project 2235 pilot evaluation. They changed the constants and we remeasured the angles to the intersections along the joints.

Point	Window 1 Az	Window 1 El	Window 4 Az	Window 4 El
7	148° 45'	74° 18'	148° 07'	74° 45'
8	151° 20'	70° 50'	150° 32'	71° 10'

Point	Window 2 Az	Window 2 El	Window 4 Az	Window 4 El
2	125° 51'	100° 16'	125° 29'	100° 05'
4	116° 56'	99° 47'	116° 35'	99° 23'
6	107° 40'	99° 04'	107° 09'	98° 24'
7	103° 07'	98° 59'	102° 37'	97° 57'

Point	Window 1 Az	Window 1 El	Window 2 Az	Window 2 El
1	135° 12'	104° 13'	135° 02'	104° 00'
4	142° 17'	115° 05'	141° 14'	114° 57'
6	147° 28'	122° 36'	146° 44'	122° 29'

We had earlier noticed that the joint between windows 2 and 6 had poor continuity but had not measured it because this joint closely parallels the leading edge of the left wing and discontinuity there should not be seriously objectionable. With the new constants, this joint got noticeably worse, and we decided to measure it as worst case (all other joints looked better than this one). Numbering from window 4 along the joint between windows 2 and 6:

Point	Window 2		Window 6	
	Az	El	Az	El
2	86° 59'	103° 19'	84° 49'	102° 50'
4	80° 45'	110° 06'	79° 08'	109° 21'
6	77° 34'	113° 21'	76° 06'	112° 33'

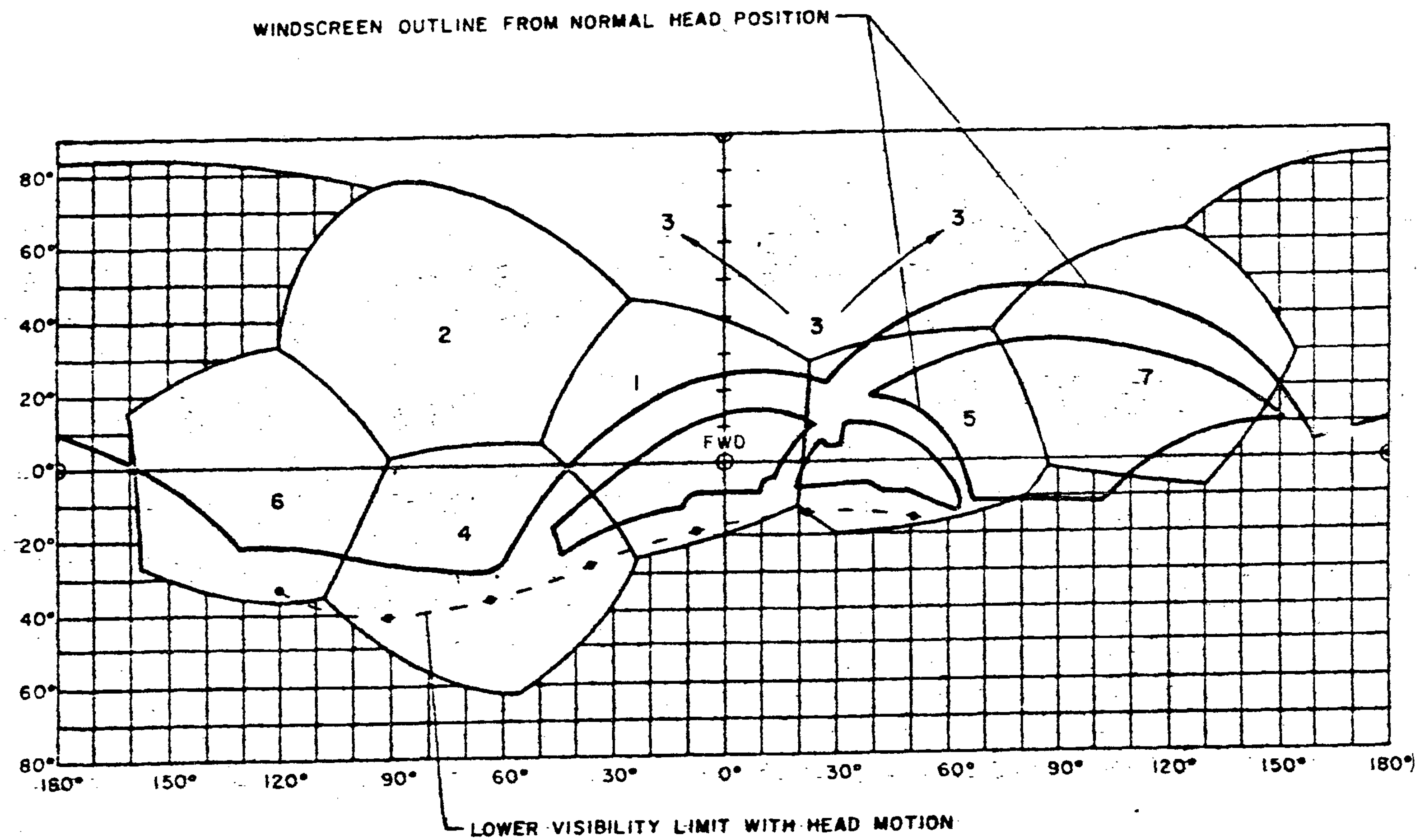


FIGURE I-1 ASUPT WINDOW NUMBERING SYSTEM

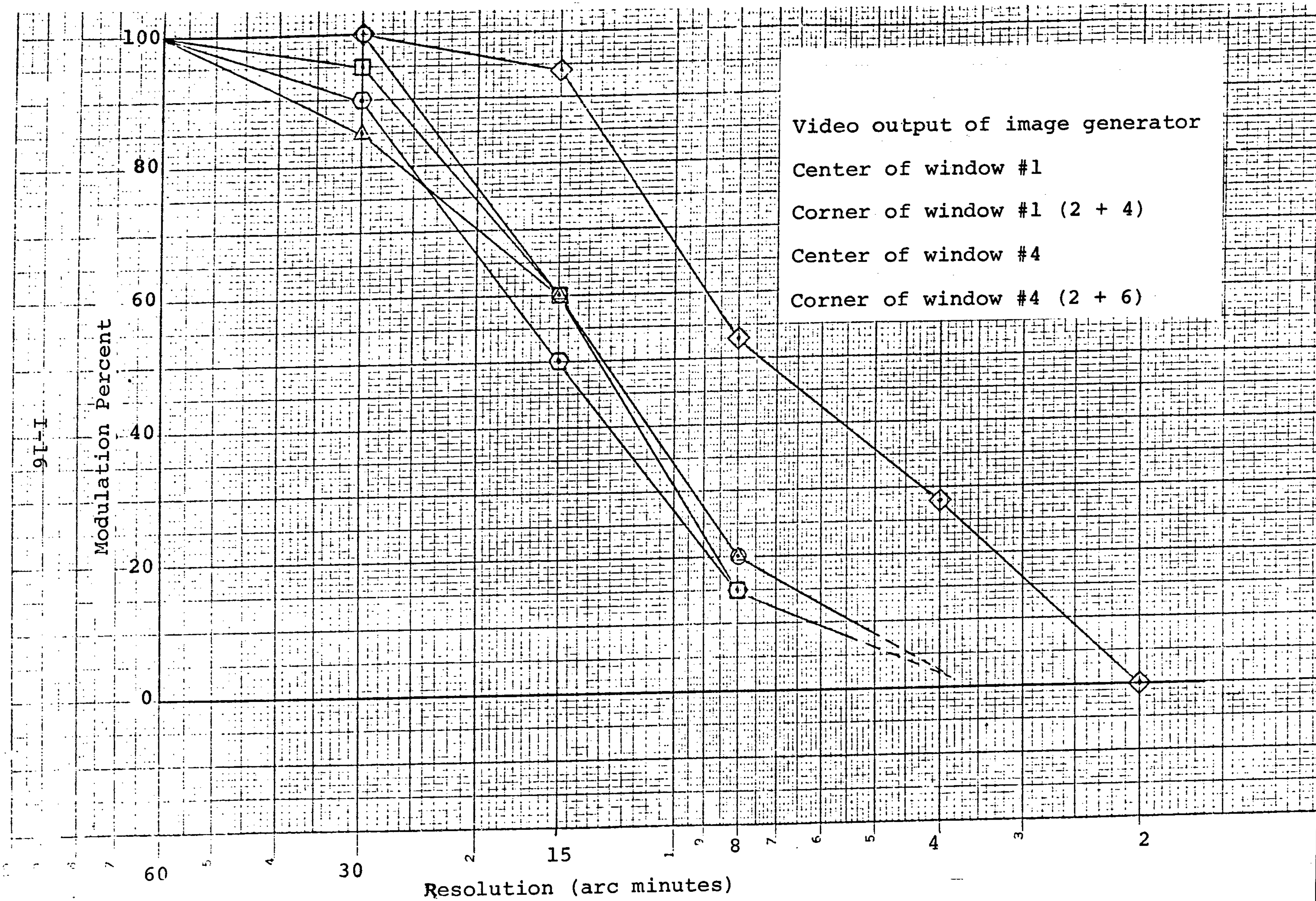


Figure I-2 ASUPT Horizontal MTF

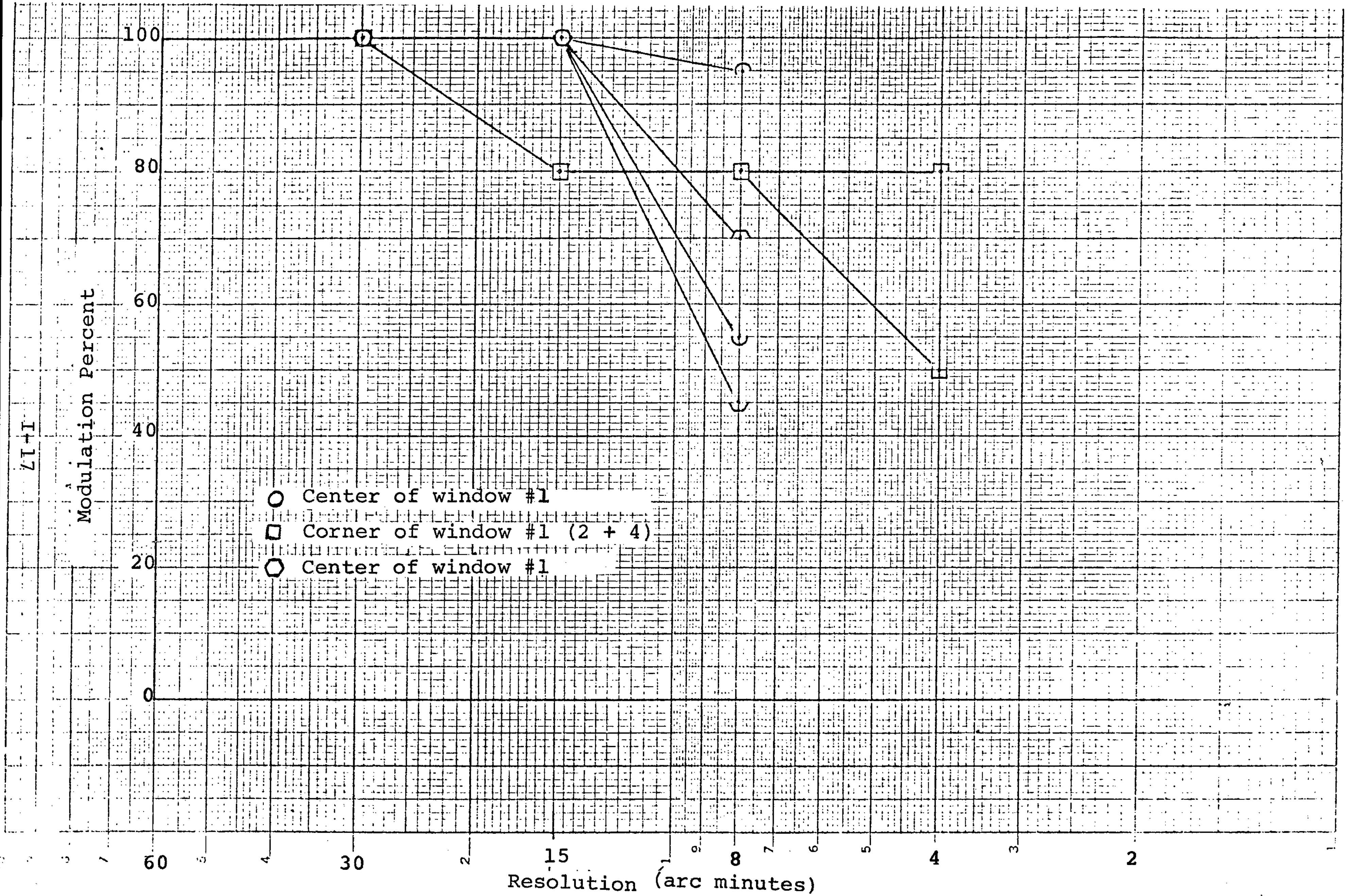


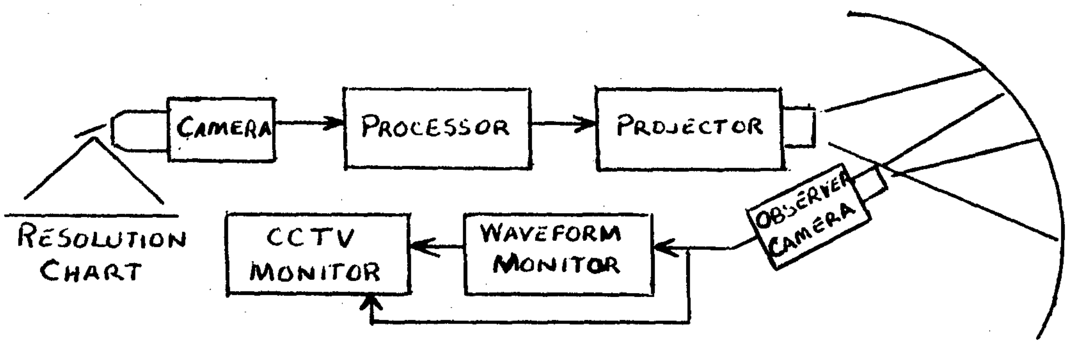
Figure I-3 ASUPT Vertical MTF

2. TMB/DOME PROJECTION SYSTEM

a. System Static Resolution/MTF

(1) Test Method: Observer Camera

Test patterns shall be viewed by the model board camera. Modulation depth of the resolution test patterns shall be measured within the display from the pilot's eyepoint using the observer camera technique.



Block Diagram

(2) Data Required

(a) Horizontal MTF at AOI center with AOI projected forward. Measure modulation depth from 1° to 2' angular resolution. Check the angles with the theodolite for each new model board camera position.

(b) Vertical MTF as above.

(c) Horizontal MTF at AOI corner with AOI projected forward.

(d) Vertical MTF as in (c).

(e) Horizontal MTF at upper right corner of AOI with AOI pointed right 90°.

(f) Horizontal MTF at lower left corner of AOI with AOI pointed right 90°.

(3) Equipment Required

(a) Modified Diamond observer camera.

(b) Kern DKM1 theodolite.

(c) Tektronix 529 waveform monitor.

(d) Light box with Sierra resolution chart.

(e) CCTV monitor for 525/60 video of the observer camera.

b. <u>System Static Resolution/MTF Results</u>

(1) Test Method

A single burst test chart was placed in the light box near the model board. Position of the burst within the display AOI was controlled by articulating the probe angular resolution in the display. The burst was controlled by varing the distance from the probe to the test chart. Angular resolution was measured for each position with a Kern DKM1 theodolite.

(2) Data

(a) Horizontal MTF at AOI center with AOI projected forward.

Angular Res.	Amplitude	% Modulation
45	140	100
31	140	100
24	140	100
17.5	120	86
14.5	100	71
10.5	55	39
9	45	32
7	20	14
6.5	20	14
5.5	10	7
5.1	5	4

(b) Vertical MTF as above.

Angular res.	Amplitude	% Modulation
45	120	100
31	115	96
24	110	92
17.5	90	75
14.5	95	79
10.5	50	42
9	55	46
7.0	30	25
6.5	25	21
5.5	15	12.5
5.1	10 (scan lines)	8

(c) Horizontal MTF at AOI corner with AOI projected forward.

Angular res.	Amplitude	% Modulation
45	140	100
31	115	82
24	120	86
17.5	130	93
14.5	115	82
10.5	70	50
9	40	29
7	25	18
6.5	15	11
5.5	5	3.6
5.1	--	

(d) Vertical MTF as in (c).

Angular res.	Amplitude	% Modulation
45	80	100
31	75	94
24	60	75
17.5	60	75
14.5	45	56
10.5	15	19
9	7	9
7.0	5	6
6.5	--	--

(e) Horizontal MTF at upper right corner of AOI with AOI pointed right 90°.

Angular Res	Amplitude	% Modulation
45	170	100
31	160	94
24	150	88
17.5	125	74
14.5	90	53
10.5	40	24
9	25	15
7	15	9
6.5	10	6
5.5	--	--

(f) Horizontal MTF at lower left corner of AOI with AOI pointed right 90°.

Angular Res	Amplitude	% Modulation
45	130	100
31	110	85
24	115	88
17.5	95	73
14.5	85	65
10.5	40	31
9	25	19
7	15	12
6.5	8	6
5.5	5	4
5.1	--	--

(g) Horizontal MTF at AOI center with AOI pointed right 90°.

Angular Res	Amplitude	% Modulation
45	180	100
31	170	94
24	160	89
17.5	145	81
14.5	120	67
10.5	70	39
9	40	22
7	25	14
6.5	12	7
5.5	--	--

(h) Vertical MTF at AOI center with AOI projected 90° right.

Angular Res	Amplitude	% Modulation
45	150	100
31	140	93
24	140	93
17.5	130	87
14.5	130	87
10.5	110	73
9	70	47
7.0	45	30
6.5	25	17
5.5	10 (Scan Lines	7

(i) Vertical MTF at lower left corner of AOI with AOI projected 90° right.

Angular Res	Amplitude	% Modulation
45	180	100
31	160	89
24	130	72
17.5	125	69
14.5	120	67
10.5	80	44
9	60	33
7.0	30	17
6.5	25	14
5.5	20	11
5.1	--	--

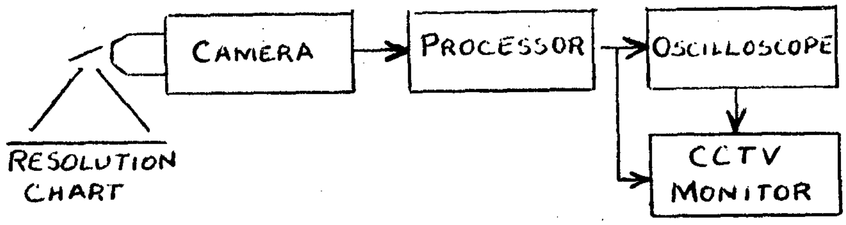
(j) Vertical MTF at upper right corner of AOI with AOI projected 90° right.

Angular Res	Amplitude	% Modulation
45	65	100
31	70	108
24	90	138
17.5	55	85
14.5	35	54
10.5	15	23
9	8	12
7.0	--	--

c. Image Generator Static Resolution/MTF

(1) Test Method: Video Signal Analysis.

Modulation depth (as a function of angular resolution) shall be measured through analysis of the video signal at the point where it enters the display.



(2) Data Required

(a) Horizontal MTF at AOI center from 1° to 2' angular resolution.

(b) Horizontal MTF at AOI corner. These measurements be obtained simultaneously with test 3.a.(3)(a) and (c).

(3) Equipment Required

(a) Tektronix 453 or equivalent.

(b) Light box with Sierra resolution chart.

(c) CCTV monitor for 625/50 video of LAMARS.

d. Image Generator Static Resolution MTF

(1) Test Method

Set-up was the same as described in test I.

(2) Data

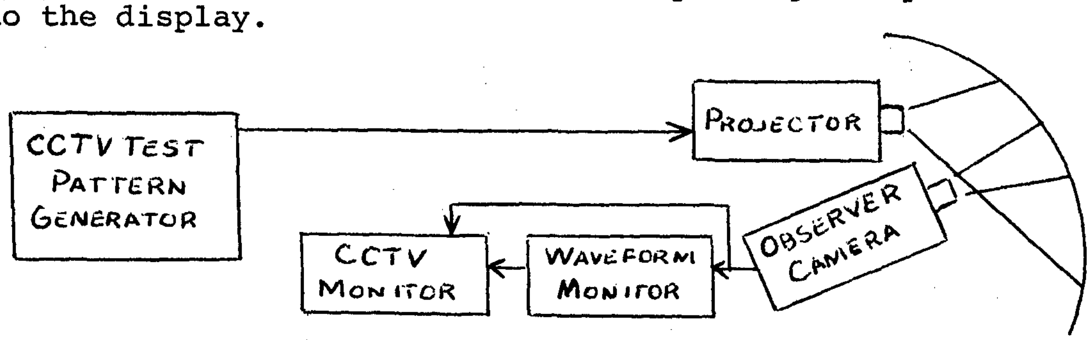
(a) Horizontal MTF at AOI center

Angular Res	Amplitude	% Modulation
45	.76	100
31	.8	105
24	.9	118
17.5	.95	125
14.5	.95	125
10.5	.9	118
9	.76	100
7.0	.5	66
6.5	.3	39
5.5	.2	26
5.1	.08	11

e. Display Static Resolution/MTF

(1) Test Method: Observer Camera.

Display modulation depth (as a function of angular resolution) shall be measured from the observer's eyepoint based on electrical test input signals provided to the display.



(2) Data Required

Same as tests 3.a (3)(a), (c), (e), and (f).

(3) Equipment Required

(a) Test pattern generator.

(b) Modified Diamond observer camera.

(c) Tektronix 529 waveform monitor.

(d) Kern DKM1 theodolite.

(e) CCTV monitor for 525/60 video of the observer camera.

f. Display Static Resolution/MTF Results

(1) Test Method

The Vii pattern generator was connected to the display and the resolution content control set for the coarsest resolution. With the resolution set to 100 lines per picture height, one line in the display was measured to be 29 arc minutes. The angular resolution was checked at 200 and 400-line settings, also, and measured 14.5 and 7.5 arc minutes, respectively.

(2) Data

(a) Horizontal MTF at AOI center with AOI projected forward.

Resolution Setting	Angular Resolution	Amplitude	% Modulation
Ref		140	140
100	29'	110	79
200	14.5	70	50
300	10'	45	32
400	7'	25	18
500	6'	17	12
600	5'	10	7
700	4'	--	--

(b) Horizontal MTF at upper right corner of AOI with AOI projected forward.

Ref		140	100
100	29.	100	71
200	14.5'	50	36
300	10'	30	21
400	7'	12	9
500	6'	8	6
600	5'	--	--

(c) Horizontal MTF at upper right corner of AOI with AOI projected 90° right.

Ref		140	100
100	29'	100	71
200	14.5'	55	39
300	10'	30	21
400	7'	15	11
500	6'	10	7
600	5'	--	--

(d) Horizontal MTF at lower left corner of AOI with AOI projected 90° right.

Resolution Setting	Angular Resolution	Amplitude	% Modulation
Ref		140	100
100	29'	100	71
200	14.5'	55	39
300	10'	30	21
400	7'	15	11
500	6'	10	7
600	5'	--	--

(e) Horizontal MTF at AOI center with AOI projected 90° right.

Ref		140	100
100	29'	120	86
200	14.5'	80	57
300	10'	50	36
400	7'	30	21
500	6'	25	18
600	5'	15	11
700	4'	8	6
800	3.5'	--	--

g. <u>Image Generator Dynamic Resolution/MTF</u>

(1) Test Method: Video Signal Analysis.

A resolution burst test target shall be located near the terrain board. The camera probe shall be set for a pitch angle of zero degrees. The probe shall then be slewed in heading to make the resolution burst pass through the display. Modulation depth shall be measured in the video as a function of angular resolution and slew speed.

Same diagram as paragraph g.

(2) Data Required

(a) Horizontal MTF at AOI center from 2° to 10' angular resolution and for heading slew rates from 2°/sec to 30°/sec. Measure the angular resolution at the display with the theodolite.

(b) Repeat test at one corner of the AOI.

(3) Equipment Required

(a) Tektronix 453 or equivalent.

(b) CCTV monitor for 625/50 video of LAMARS.

(c) Light box with resolution burst test chart.

(d) Kern DKM1 theodolite.

(e) Stopwatch.

h. Image Generator Dynamic Resolution/MTF Results

(1) Test Method

As preplanned.

(2) Data

(a) Heading set to complete one revolution in 90 seconds (4°/sec)

Angular Res	Amplitude	% Modulation
45	.76	100
31	.76	100
24	.8	105
17.5	.84	111
14.5	.85	112
10.5	.85	112
9	.75	99
7.0	.4	53
6.5	.24	32
5.5	.12	16
5.1	.05	7

(b) One revolution in 65 seconds (5.5^{o}/sec).

Angular Res	Amplitude	% Modulation
45	.7	92
31	.72	95
24	.76	100
17.5	.82	108
14.5	.85	112
10.5	.8	105
9	.56	74
7.0	.32	42
6.5	.22	29
5.5	.1	13
5.1	.04	5

(c) One revolution in 40 sec (9^{o}/sec).

45	.7	92
31	.68	89
24	.76	100
17.5	.8	105
14.5	.7	92
10.5	.52	68
9	.3	39
7.0	.2	26
6.5	.1	13
5.5	.05	7
5.1	.04	5

(d) One revolution in 21 sec (17^{o}/sec)

45	.6	79
31	.6	79
24	.6	79
17.5	.45	59
14.5	.3	39
10.5	.16	21
9	.04	5
7.0	.04	5
6.5	.04	5
5.5	--	

(e) One revolution in 12.5 sec (29^{o}/sec).

Angular Res	Amplitude	% Modulation
45	.55	72
31	.4	53
24	.3	39
17.5	.16	21
14.5	.06	8
10.5	.1	13
9	.08	11
7.0	--	--

(f) One revolution in 9 sec (40^{o}/sec).

45	.5	66
31	.35	46
24	.1	13
17.5	.08	11
14.5	.2	26
10.5	--	--

i. <u>Display Brightness, Gray Scale, Contrast, Shading</u>

(1) Test Method: Photometer.

A test pattern shall be displayed which includes a gray scale, peak white, and peak black targets located in the center and corners of the field of view. The video shall have a 50% APL. A photometer shall be located at the pilot's eyepoint and shall be used to measure:

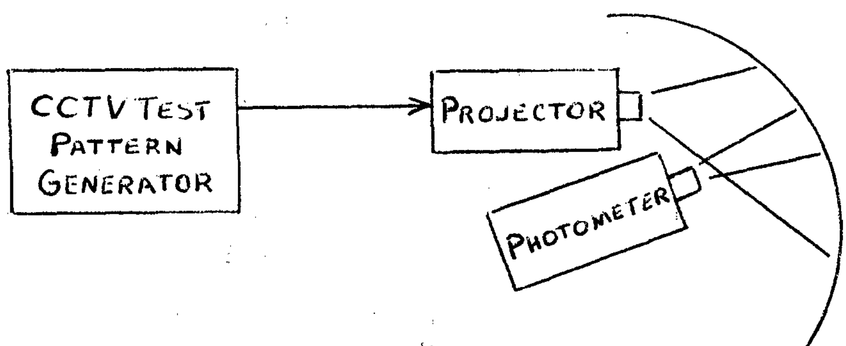
(a) Peak picture brightness.

(b) Black picture brightness.

(c) Brightness of each gray step.

(d) Contrast Ratio.

(e) Picture Shading.



Block Diagram

(2) Data Required

(a) Measure brightness of each step of a ten step linear gray scale at the center and one corner of the AOI with the AOI projected forward. Keep the photometer and the AOI fixed, and slew the display by varying the horizontal position on the VII generator.

(b) Repeat test with the AOI projected 90° right.

(c) With an unmodulated raster on the display, measure brightness at the center and each corner of the AOI with the AOI projected forward.

(d) Repeat test (3) with the AOI projected 90° right.

(3) Equipment Required

(1) VII CCTV pattern generator.

(2) Pritchard photometer.

j. <u>Display Brightness, Gray Scale, Contrast, Shading Results</u>

(1) Test Method

For shading and AOI center gray scale, the VII generator was set to display a gray scale horizontally across the center of the AOI. The remainder of the AOI was set for a 50% APL flat field. For gray scale readings in the corner of the AOI, the generator was switched to full field gray scale.

(2) Data

(a) Gray scale brightness at AOI center with the AOI projected forward.

Step	Brightness (footlamberts)
1	.078
2	.082
3	.102
4	.158
5	.238
6	.32
7	.39
8	.439
9	.47
10	.505

At upper right corner of the AOI, black measured .045 footlamberts and white measured .48 footlamberts.

(b) AOI projected 90° right.

	AOI center	Upper right
Black	.078	.04
White	.512	.50

Measurement of all steps of the gray scale appeared to be redundant.

(c) Shading of 50% APL flat field with AOI projected forward.

Point	Brightness
Above center	.24
Below center	.23
Upper right	.24
Upper left	.225
Lower left	.22
Lower right	.22

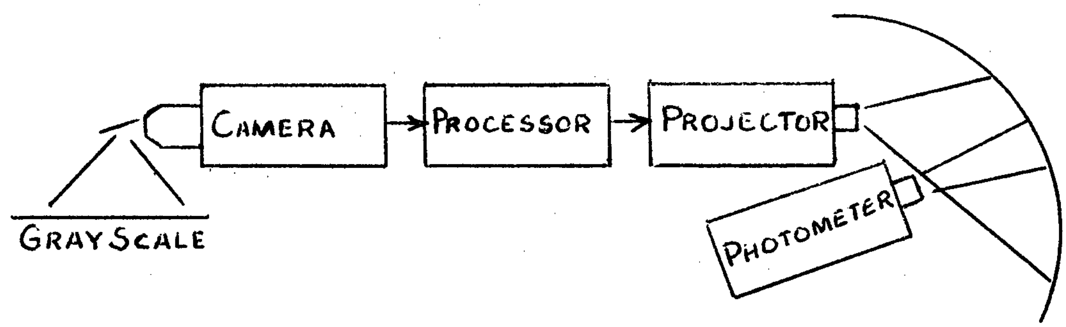
(d) Shading of 50% APL flat field with AOI projected 90° right.

Above center	.295
Below center	.295
Upper right	.24
Upper left	.24
Lower left	.23
Lower right	.3

k. System Brightness, Gray Scale, Contrast, Shading

(1) Test Method: Photometer.

The gantry camera shall be set up to view a test pattern as discussed in test V.



Block Diagram

(2) Data Required

Measure brightness of each step of a ten step linear gray scale at the center and one corner of the AOI with AOI projected forward. Keep the photometer and the AOI fixed; slew the probe to position the gray scale steps.

(3) Equipment Required

(a) Gray scale test chart (linear ten step).

(b) Pritchard photometer.

1. <u>System Brightness, Gray Scale Contrast, Shading Results</u>

(1) Test Method

A reflective gray scale was set up on the model board. The probe was slewed to position the steps individually at a given point in the display. The complete scale was measured only at AOI center. We also measured a selection of points on the background projections. Some earlier tests had indicated that there might be some brightness variation as a function of camera probe pitch. We, therefore, added a test wherein a given patch of gray was kept fixed in the display while varying probe pitch and position.

(2) Data

(a) Ten-step gray scale at AOI center with AOI projected forward.

Step	Brightness
1	.055
2	.05
3	.06
4	.099
5	.16
6	.2
7	.34
8	.415
9	.505
10	.56

(b) Black and white targets at the upper right corner of the AOI with the AOI projected forward.

Black	.05
White	.52

(c) Brightness as a function of pitch. Readings taken on step 6 of reflective gray scale at AOI center.

Pitch	Brightness
+20°	.318
0	.322
-15°	.320
-30°	.318
-47.5°	.310

(d) Background brightness

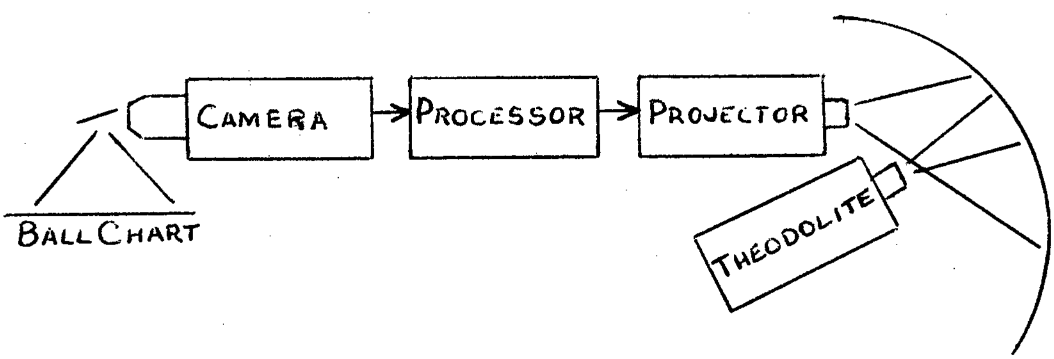
Terrain	.12
Sky	.18
Above horizon	.35

These readings are representative. There was very little variation over the terrain; the sky had more variation but never exceeded about .25 footlamberts except near the horizon.

m. System Geometric Distortion, AOI Field of View, and AOI Dynamic Envelope Size

(1) Test Method: Theodolite.

A linearity test pattern shall be viewed by the system image generator camera. A theodolite shall be located at the pilot's eyepoint and shall be used to measure field of view, display linearity, and AOI envelope size.



Block Diagram

(2) Data Required

(a) Measure angles to each edge of the AOI with the AOI field of view at maximum size and projected forward.

(b) With the AOI projected forward, measure angles to 36 data points on a standard linearity chart (ball chart).

(c) Repeat test with AOI projected 90° right.

(d) Project AOI max left with zero degrees elevation and measure angle to left edge of AOI field of view.

(e) Make measurements similar to four, for max right, max up, and max down. Exclude software limitations on positioning AOI field of view.

(3) Equipment Required

(a) Kern DKM1 theodolite.

(b) Light box with ball chart.

n. <u>System Geometric Distortion Results</u>

(1) Test Method

The camera probe was set up to view a grid pattern in a light box. The camera and optics were then adjusted so that the diagonal field of view would be 60 degrees. The grid pattern was projected in the cockpit display and a theodolite used to measure the azimuth and elevation angles to a selection of points in the grid. The theodolite was only approximately aligned with the pilot's eyepoint. The azimuth was calibrated to the forward cross on the dome, and the remaining angles were measured to the other crosses. The angles were as follows:

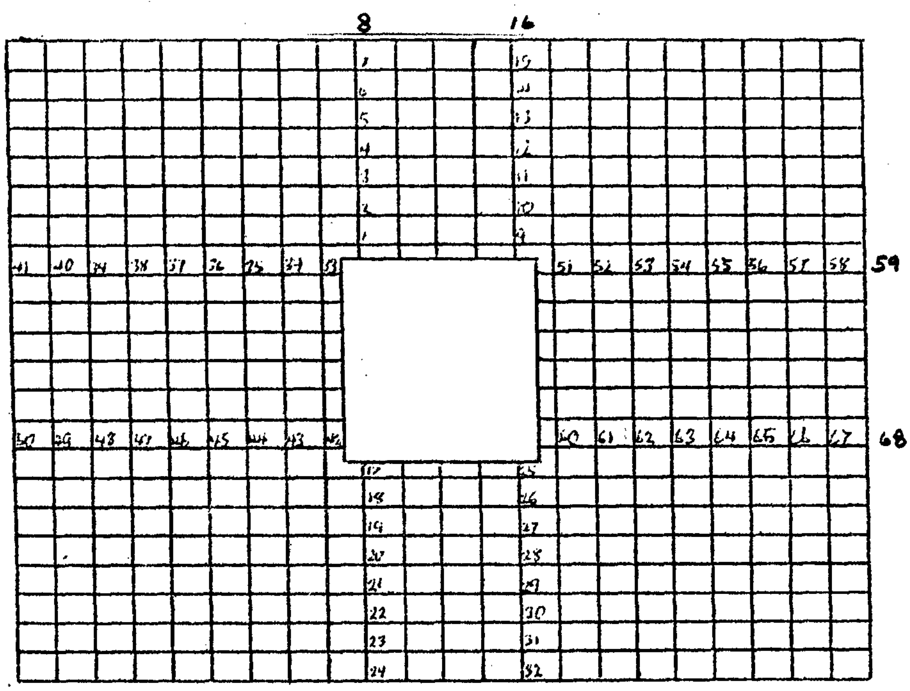
	Azimuth	Elevation
Front	360°	89° 36'
Right	90° 23'	88° 25'
Left	270° 09'	87° 43'

It can be shown that these angles indicate that the theodolite viewpoint was located .244 inches in front, .557 inches to the right, and 4.051 inches above the nominal pilot's eyepoint. It can further be shown that the maximum error in measuring the viewing angles to any point in the AOI relative to the center of the AOI is seven arc minutes.

(2) Data

(a) Angles to the edges of the AOI are a subset of the angles measured in step 2.

(b) Geometric distortion with the AOI projected forward. The grid pattern had the general appearance shown below:



Point	Azimuth	Elevation
3	356° 58'	99° 28'
4	356° 55'	101° 04'
6	356° 27'	104° 12'
8	356° 40'	107° 15'
10	5° 40'	97° 13'
12	5° 18'	101° 05'
14	5° 18'	104° 12'
16	5° 37'	107° 17'
17	357° 15'	83° 18'
19	357° 15'	79° 59'
21	357° 13'	76° 30'
22	357° 09'	74° 44'
25	5° 46'	83° 18'
27	5° 48'	79° 57'
29	5° 53'	76° 35'
31	5° 58'	73° 07'
33	354° 53'	94° 34'
35	350° 26'	94° 34'
39	341° 02'	94° 44'
41	336° 33'	94° 52
42	355° 16'	84° 49'
44	350° 36'	84° 51'
46	346° 02'	84° 55'
48	341° 19'	84° 55'
50	336° 45'	85° 05'
51	7° 46'	94° 38'
55	16° 28'	95° 01'
57	20° 54'	95° 13'
59	24° 30'	95° 23'
60	7° 52'	84° 59'
62	12° 08'	85° 09'
64	15° 30'	85° 25'
66	20° 52'	85° 36'
68	24° 29'	85° 53'

(c) Geometric distortion with the AOI projected 90° right.

Point	Azimuth	Elevation
1	87° 41'	96° 44'
3	87° 30'	99° 30'
5	87° 39'	102° 33'
8	87° 52'	106° 59'
9	95° 28'	96° 05'
11	95° 37'	99° 08'
13	95° 48'	102° 02'
16	96° 06'	106° 17'
17	87° 04'	83° 47'
19	87° 02'	80° 33'
20	87° 00'	78° 51'
21	86° 57'	77° 08'
23	86° 57'	73° 37'
24	86° 57'	71° 51'
25	95° 08'	84° 13'
27	95° 07'	81° 06'
29	95° 10'	77° 54'
32	95° 26'	72° 55'
33	85° 20'	95° 00'
35	81° 07'	95° 06'
36	78° 54'	95° 11'
37	76° 35'	95° 16'
39	71° 44'	95° 32'
41	67° 17'	--
42	85° 03'	85° 21'
44	80° 47'	85° 18'
46	76° 14'	85° 11'
48	71° 26'	85° 13'
50	66° 49'	85° 13'
51	97° 15'	94° 50'
53	101° 03'	94° 55'
55	105° 00'	95° 00'
57	108° 54'	95° 07'
59	111° 56'	---
60	97° 02'	85° 58'
62	100° 59'	86° 15'
64	104° 47'	86° 34'
66	108° 47'	86° 54'
68	111° 58'	---

Left end of upper edge	108° 31' El
Right end of upper edge	105° 55' El
Left end of lower edge	71° 04' El
Right end of lower edge	74° 20' El

(d) No measurements were taken on the AOI dynamic envelope size. It was demonstrated that the projector was capable of projecting beyond the edges of the screen horizontally and from nearly vertical to into the cockpit vertically. Thus, there are no mechanical limits to placing the AOI anywhere within the field of view of the pilot.

o. AOI Edge Transition Quality

(1) Test Method: Observer camera.

A uniform flat field (50% APL) shall be displayed in the AOI. An observer camera shall be used to measure the transition between the AOI and the background image.

Block Diagram same as test C.

(2) Data Required

(a) Measure rise time of edge transition at all four edges of the AOI with the AOI projected forward.

(b) Repeat with AOI projected 90° right.

(3) Equipment Required

(a) VII CCTV pattern generator.

(b) Modified Diamond observer camera.

(c) Tektronix 529 waveform monitor.

(d) CCTV monitor for 525/60 video of the observer camera.

p. AOI Edge Transition Quality Results

(1) Test Method

The observer camera was set up to view each of the edges of the AOI after vignetting was added. With a 75mm lens of the camera and the camera set to scan a 15.7mm diagonal, 3x4-format on the tube, the horizontal field of view of the camera is 9.6°. A horizontal scan line as viewed on the waveform monitor may thus be read as $.96^{\circ}$ per division.

(2) Data

The edge transitions with the vignetting installed was gradual enough on the right, left, and bottom of the AOI to make it very difficult to decide where the transition began or ended. With the AOI projected forward or 90° right, all these edges appeared to transition in about 3.5 divisions or about 3.4°. No vignetting was apparent on the top edge of the AOI, and its transition occurred over about .25 degrees.

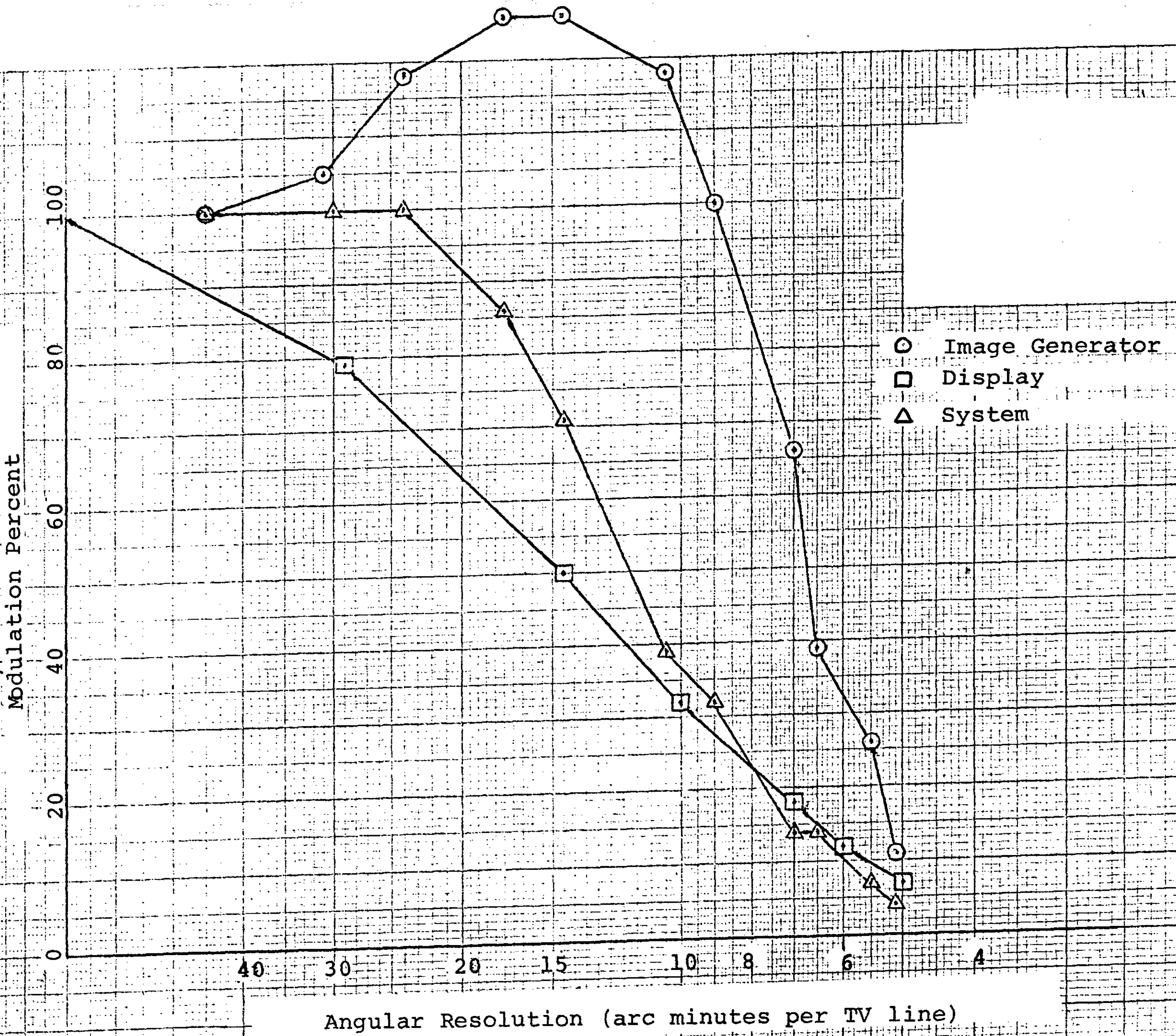


Figure 1-4 AOI Static Resolution/MTF
(AOI forward center)

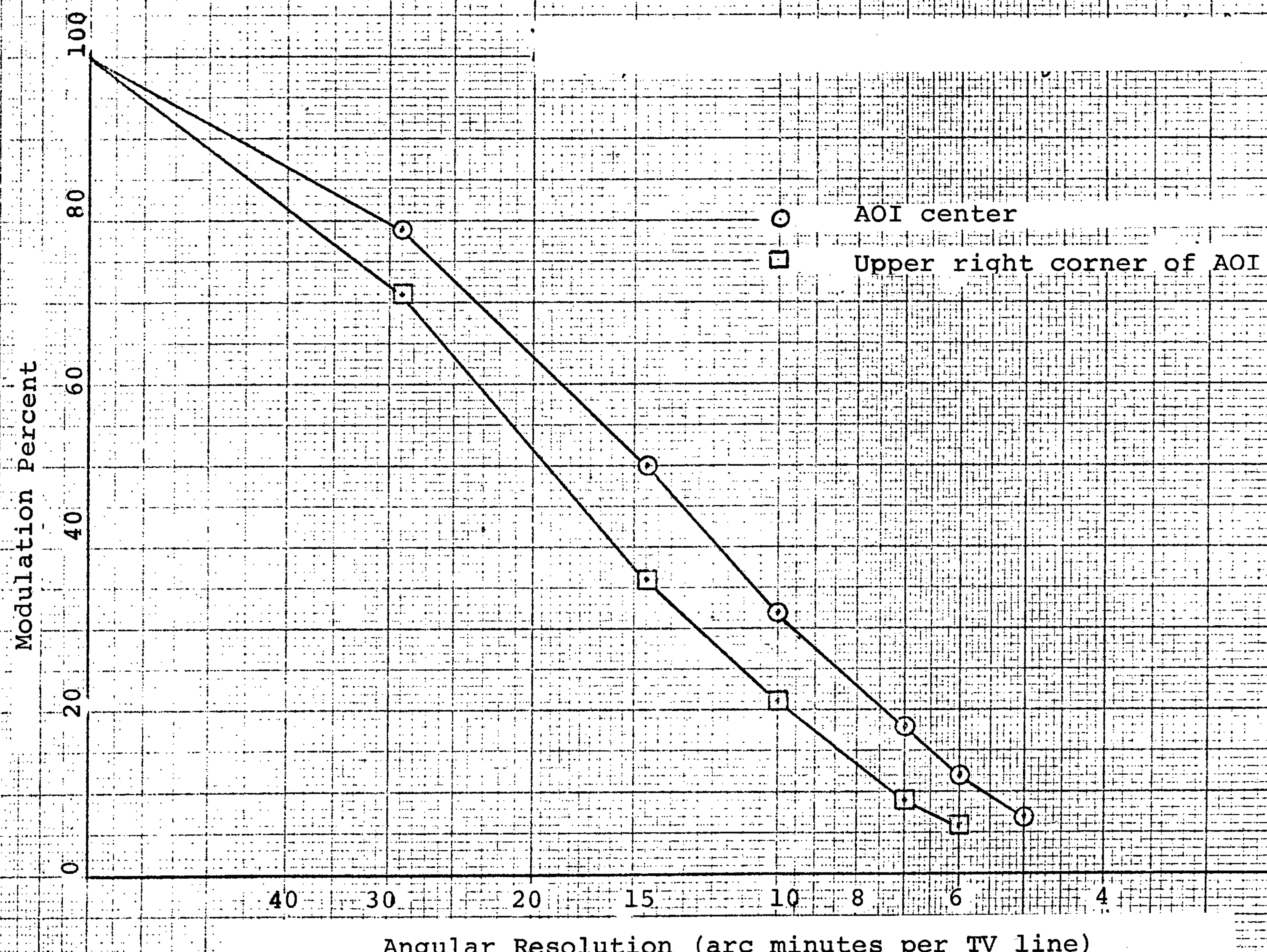


Figure I-5 Display MTF (AOI projected forward)

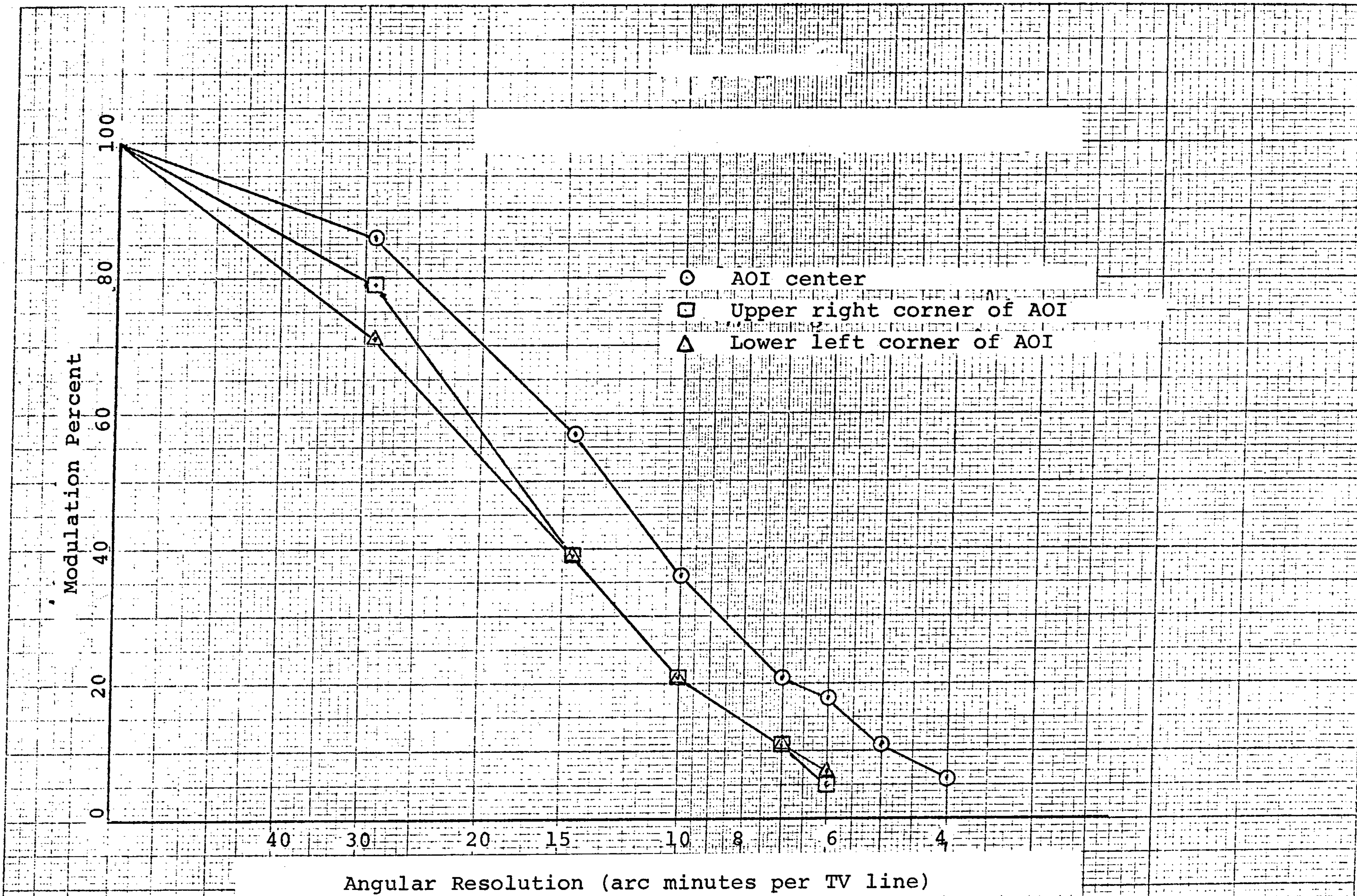


Figure I-6 Display MTF (AOI projected 90° right)

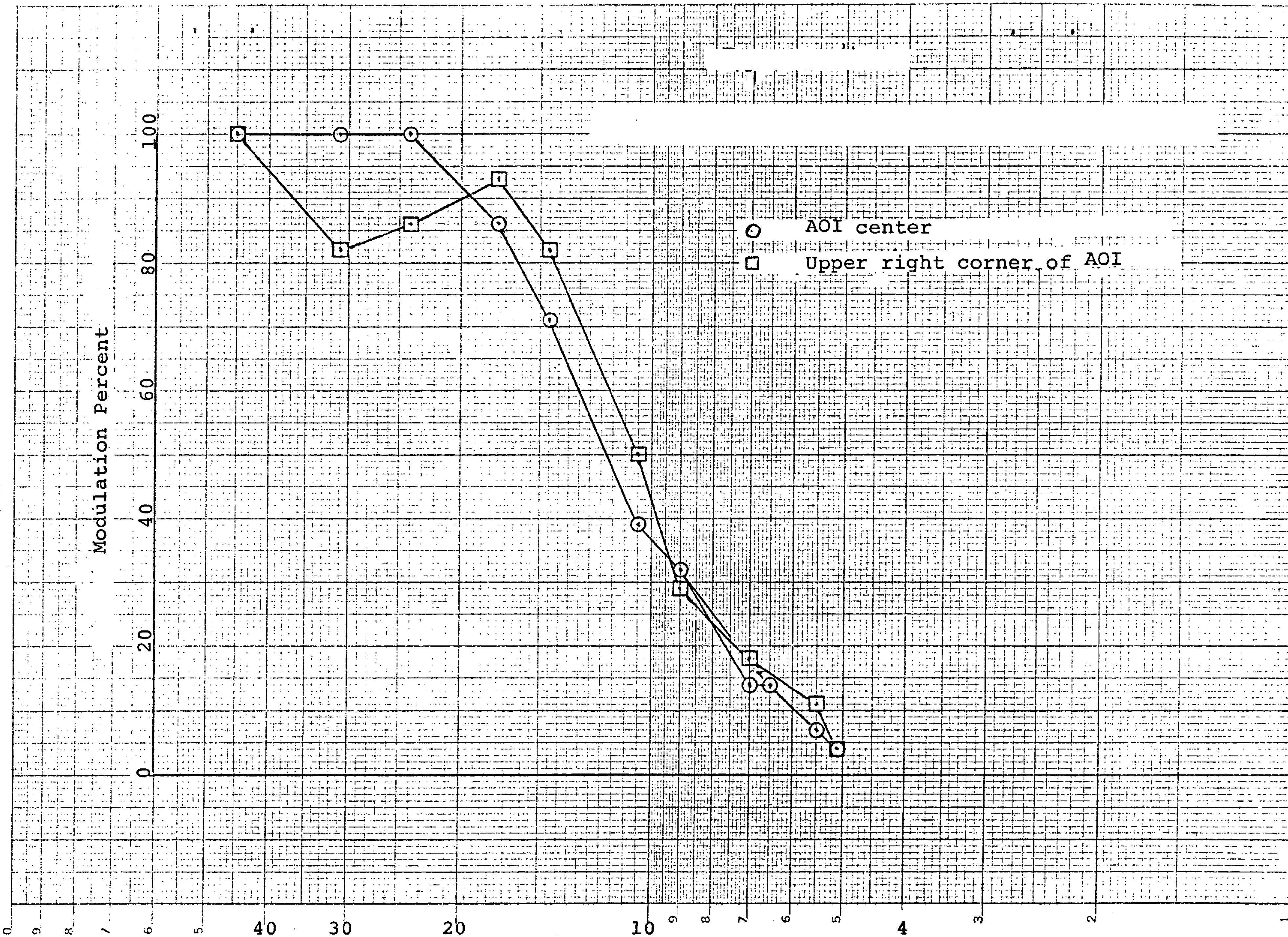


Figure I-7 Horizontal MTF (AOI projected forward)

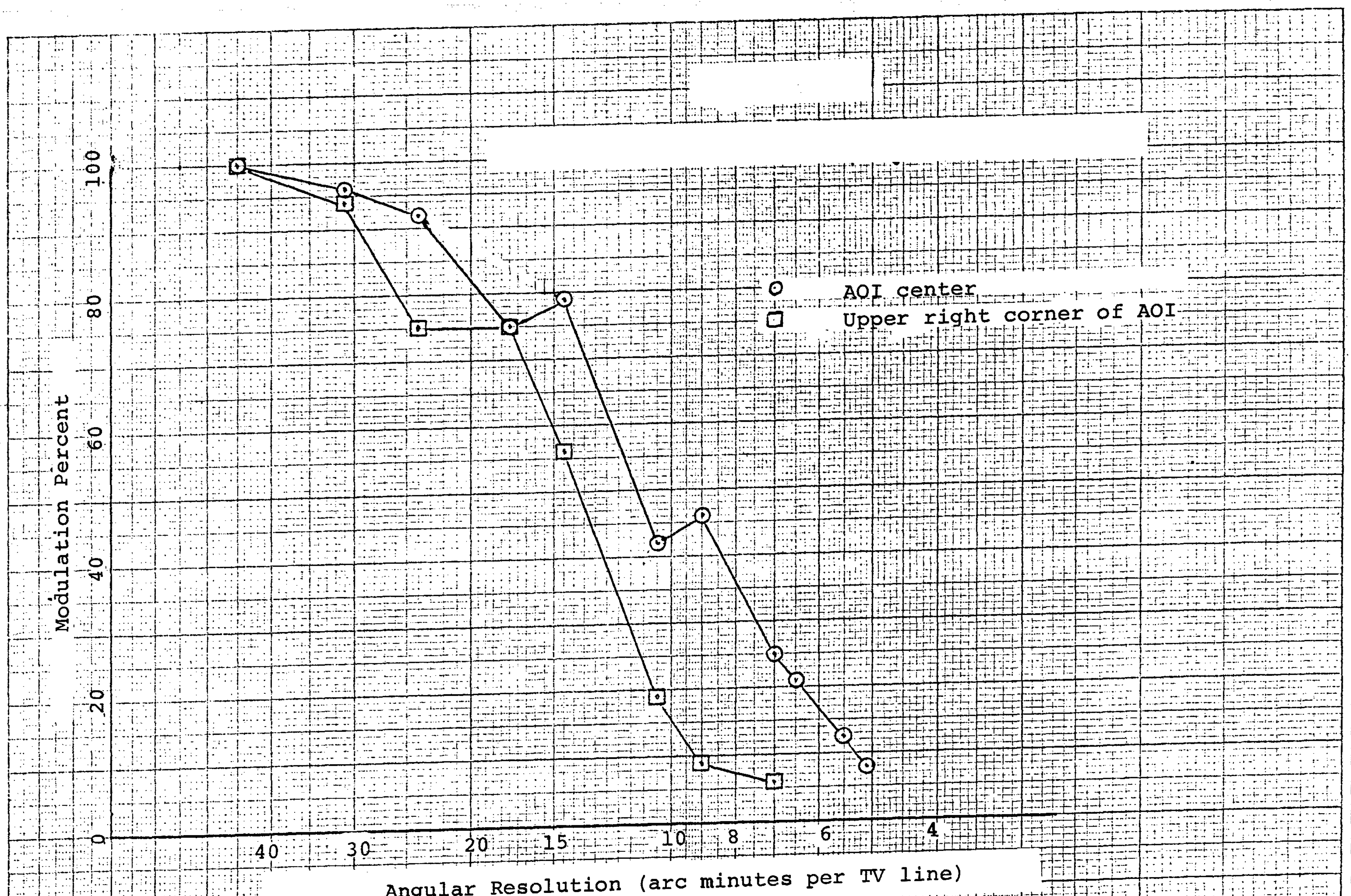


Figure I-8 Vertical MTF (AOI projected forward)

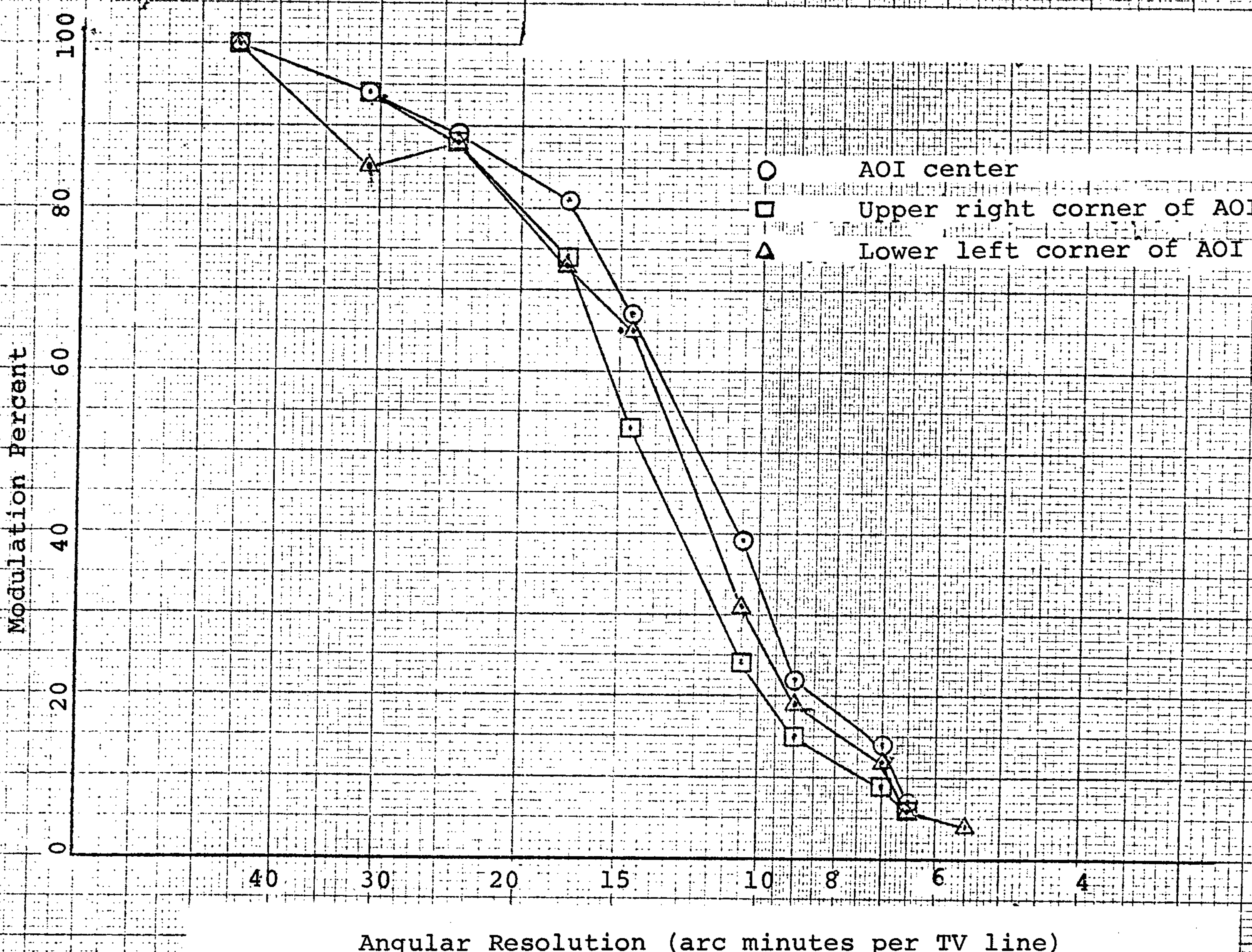


Figure I-9 Horizontal MTF (AOI projected 90° right)

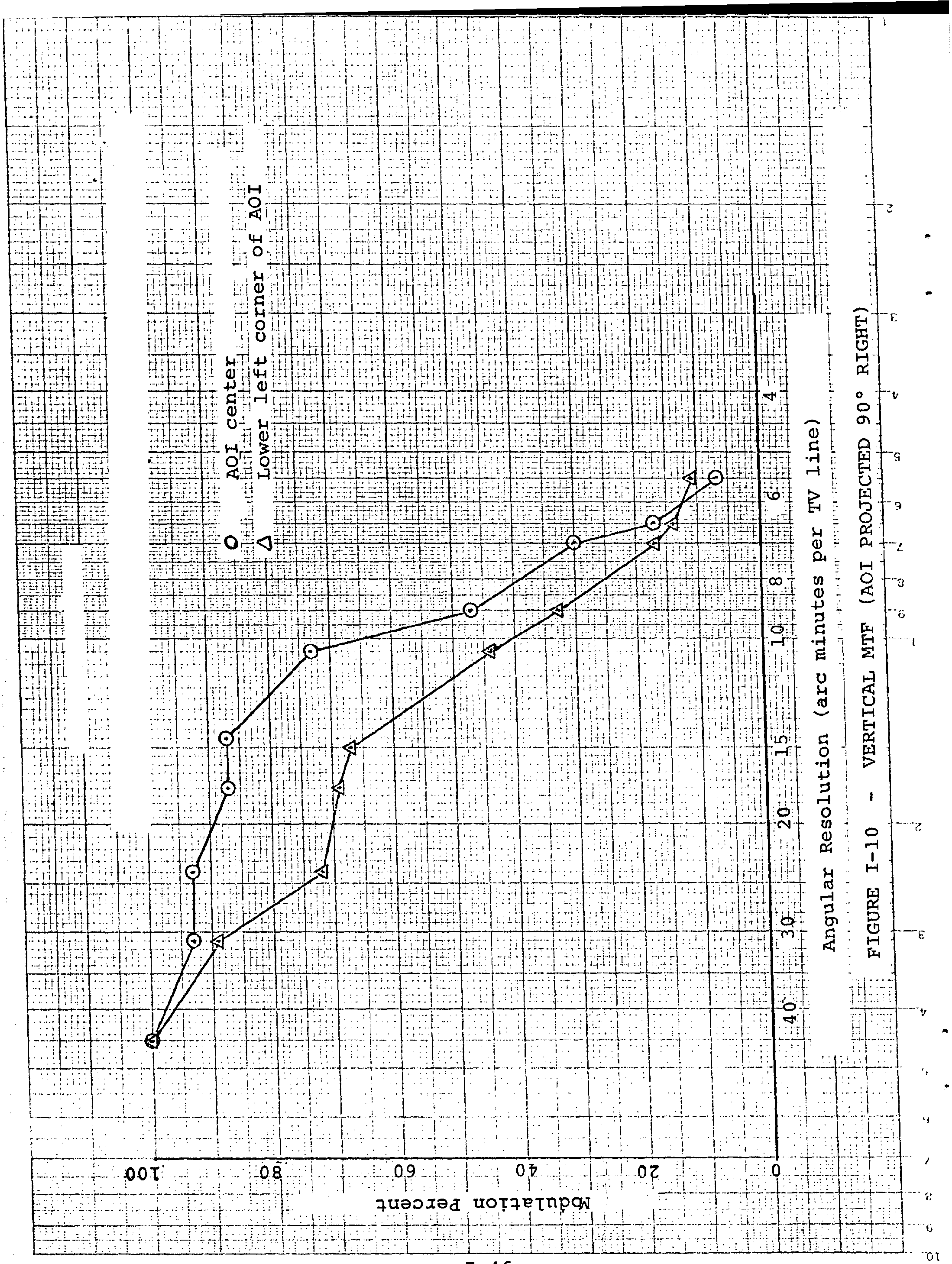


FIGURE I-10 - VERTICAL MTF (AOI PROJECTED 90° RIGHT)

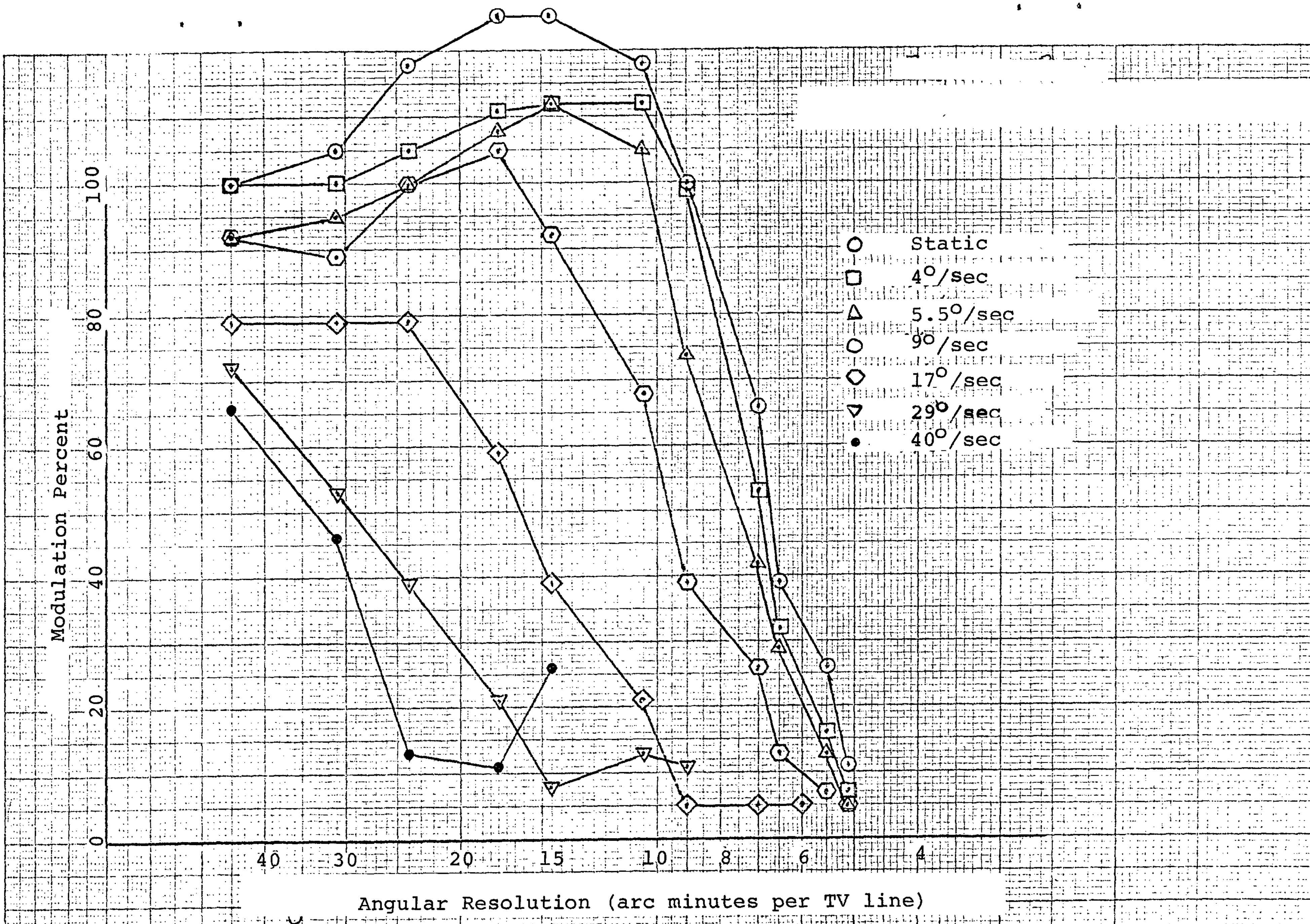


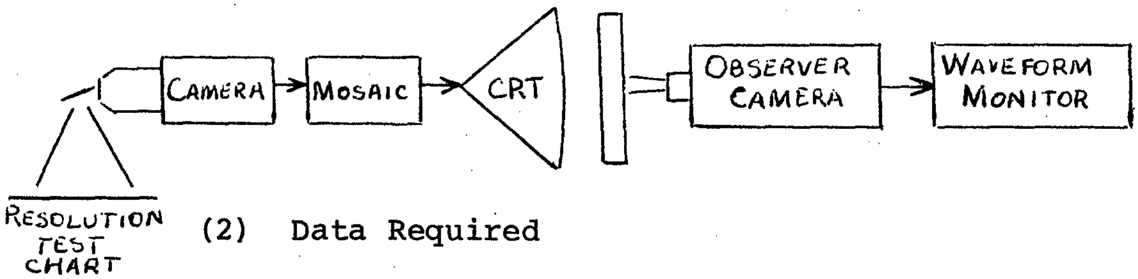
Figure I-11 Image Generator Dynamic Resolution/MTF

3. TMB/OPTICAL MOSAIC SYSTEM

a. System Static Resolution/MTF

(1) Test Method: Observer Camera

Test patterns shall be viewed by the model board camera probe. Modulation depth of the resolution test patterns shall be measured within the display from the pilot's eyepoint using the observer camera technique.



(2) Data Required

(a) Horizontal modulation depth at AOI center with the AOI centered in the forward window, background off.

(b) Vertical modulation depth as above.

(c) Horizontal modulation depth at AOI corner with the AOI positioned to place that corner in a corner of the forward window.

(d) Vertical modulation depth as in (c).

(e) Repeat steps (a) - (d) in a second window.

b. System Static Resolution/MTF Results

(1) Test Method

The test was run as planned using the light box and square resolution chart available at Luke AFB. To get a better sample, data was collected in three windows instead of two. Other slight variations are noted below (reference Figure I-12 for window numbering system).

(2) Data

(a) Horizontal modulation depth at AOI center with the AOI centered in the window. It was unnecessary to turn off the background since a new circuit had been added to blank the background at the location of the AOI. Data was collected from two resolution wedges located immediately above and below AOI center.

1. Window 2

ANGULAR RES	Above Center AMPLITUDE	Above Center MOD%	Below Center AMPLITUDE	Below Center MOD%
Ref	90	100	60	100
12'	10	11	8	13
10.5'	5	6	5	8
9.5'	3	3	5	8
8'	2	2	2	3
7'	0	0	0	0

2. Window 3

ANGULAR RES	Above Center AMPLITUDE	Above Center MOD%	Below Center AMPLITUDE	Below Center MOD%
Ref	100	100	100	100
12'	8	8	8	8
10.5'	7	7	6	6
9.5'	5	5	5	5
8'	2	2	2	2
7'	0	0	0	0

3. Window 6

ANGULAR RES	Above Center AMPLITUDE	Above Center MOD%	Below Center AMPLITUDE	Below Center MOD%
Ref	95	100	90	100
12'	12	13	12	13
10.5'	10	11	12	13
9.5'	8	8	10	11
8'	5	5	5	6
7'	2	2	2	2
6'	0	0	0	0

(b) Vertical modulation depth as above. Data was taken on wedges left and right of AOI center. The first 6' reading is taken from the inner end of the wedge which spans 12' to 6'; the second 6' reading is taken from the outer end of the wedge which spans 6' to 3'.

1. Window 2

ANGULAR RES	Left of Center AMPLITUDE	Left of Center MOD%	Right of Center AMPLITUDE	Right of Center MOD%
Ref	100	100	90	100
12'	30	30	60	67
10.5'	30	30	45	50
9.5'	23	23	35	39
8'	15	15	22	24
7'	10	10	10	11
6'	5	5	5	6
6'	3	3	12	13
5.5'	3	3	10	11
5'	2	2	6	7
4'	0	0	2	2
3.5'	0	0	0	0

2. Window 3

ANGULAR RES	Left of Center AMPLITUDE	Left of Center MOD%	Right of Center AMPLITUDE	Right of Center MOD%
Ref	100	100	100	100
12'	30	30	50	50
10.5'	30	30	40	40
9.5'	25	25	30	30
8'	13	13	17	17
7'	6	6	5	5
6'	2	2	2	2
6'	0	0	3	3
5.5'	0	0	2	2
5'	0	0	0	0

3. Window 6

ANGULAR RES	Left of Center AMPLITUDE	Left of Center MOD%	Right of Center AMPLITUDE	Right of Center MOD%
Ref	90	100	80	100
12'	40	44	50	62
10.5'	35	39	42	52
9.5'	30	33	32	40
8'	18	20	18	22
7'	12	13	10	12
6'	6	7	0	0
6'	6	7	10	12
5.5'	0	0	7	9
5'	0	0	0	0

(c) Horizontal modulation depth at a corner of the window. Resolution wedges in the AOI corners began at 6' resolution and showed no modulation depth for any position of the AOI. We thus positioned an AOI center resolution wedge in the corner of the window.

1. Window 2 near 2, 3, 6 tri-joint. No modulation depth readings were possible. Limiting resolution appeared subjectively to be about 250 TV lines (9.5 arc minutes).

2. Window 3 near 2, 3, 6 tri-joint

ANGULAR RES	AMPLITUDE	MOD%
Ref	100	100
12'	8	8
10.5'	8	8
9.5'	7	7
8'	5	5
7'	3	3
6'	0	0

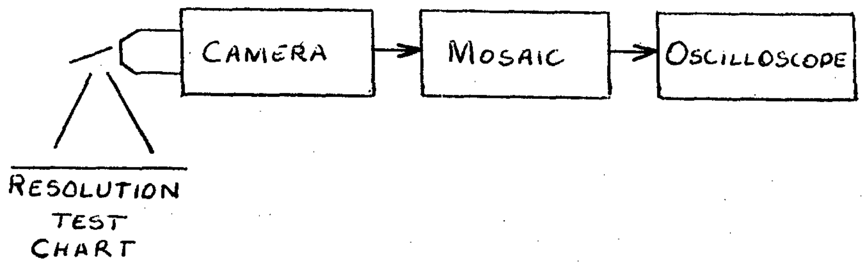
(d) Vertical modulation depth as in step (c).

ANGULAR RES	Window 2 AMPLITUDE	Window 2 MOD%	Window 3 AMPLITUDE	Window 3 MOD%
Ref	60	100	100	100
12'	60	100	80	80
10.5'	50	83	70	70
9.5'	40	67	60	60
8'	20	33	40	40
7'	12	20	25	25
6'	5	8	10	10
6'	10	17	33	33
5.5'	3	5	26	26
5'	0	0	15	15
			0	0

c. Image Generator Static Resolution/MTF

(1) Test Method: Video Signal Analysis

Modulation depth (as a function of angular resolution in the display) shall be measured through analysis of the video signal at the point where it enters the display.



(2) Data Required

(a) Horizontal modulation depth at AOI center.

(b) Horizontal modulation depth at AOI corner.

d. Image Generator Static Resolution/MTF Results

(1) Test Method

Modulation depth in the video was measured at the model board camera output in addition to the preplanned display input.

(2) Data

(a) Horizontal modulation depth at AOI center.

1. At model board camera output.

	Above Center		Below Center	
ANGULAR RES	AMPLITUDE	MOD%	AMPLITUDE	MOD%
Ref	5	100	5	100
12'	2	40	2	40
10.5'	1.8	36	1.6	32
9.5'	1.6	32	1.6	32
8'	1.4	28	1.4	28
7'	1.2	24	1.0	20
6'	1.0	20	.8	16
6'	.8	16	1.0	20
5.5'	.8	16	.6	12
5'	.6	12	.6	12
4'	.4	8	.4	8
3.5'	0	0	0	0

2. At display input.

ANGULAR RES	Above Center AMPLITUDE	MOD%	Below Center AMPLITUDE	MOD%
Ref	5.3	100	5.3	100
12'	1.8	34	1.8	34
10.5'	1.6	30	1.6	30
9.5'	1.4	26	1.4	26
8'	1.3	25	1.2	23
7'	1.0	19	1.0	19
6'	.8	15	.7	13
6'	.8	15	.7	13
5.5'	.6	11	.5	9
5'	.4	8	.4	8
4'	0	0	0	0

(b) Horizontal modulation depth at AOI corner. The resolution wedges in the corners of the chart begin at 6 arc minutes (400 TV lines). There are four wedges in each corner, two for vertical modulation showed line structure to about 4 arc minutes (600 TV lines), but most of the structure appeared to be from interference with scan lines. The inner wedges for horizontal modulation showed approximately 10% modulation depth at 6 arc minutes in the lower corners. Limiting resolution in the lower corners was subjectively about 5 arc minutes (500 TV lines).

e. Display Static Resolution/MTF

(1) Test Method: Observer Camera

Display modulation depth (as a function of angular resolution) shall be measured from the pilot's eyepoint based on electrical test input signals provided to the display.

(2) Data Required

(a) Horizontal modulation depth at AOI center with the AOI centered in the forward window, background off.

(b) Horizontal modulation depth at AOI corner with the AOI positioned to place that corner in a corner of the forward window.

(c) Horizontal modulation depth at AOI center with the AOI centered in the forward window, background successively at each of its four shades of gray.

(d) With the pattern generator connected to the large raster input, measure horizontal modulation depth at center of forward window, AOI off.

(e) Horizontal modulation depth of large raster at one corner of the forward window.

(f) Horizontal modulation depth at center of AOI with AOI centered in a second window.

f. Display Static Resolution/MTF Results

(1) Test Method

Test was run as planned on an extra window and eliminating measurements with the AOI superimposed over the STG. The new STG hole-cutter made such tests irrelevant.

(2) Data

(a) Horizontal modulation depth at AOI center with the AOI centered in the window.

	Window 2		Window 3		Window 6	
ANGULAR RES	AMP	MOD%	AMP	MOD%	AMP	MOD%
Ref	115	100	100	100	100	100
33'	85	74	90	90	80	80
16.5'	30	26	45	45	65	65
11'	16	14	30	30	48	48
8'	8	7	35	35	15	15
6.5'	9	8	20	20	15	15
5.5'	2	2	10	10	5	5
4.5'	0	0	0	0	0	0

(b) Horizontal modulation depth at AOI corner with the AOI positioned to place that corner near trijoint 2, 3, and 6.

ANGULAR RES	Window 2 AMPLITUDE	Window 2 MOD%	Window 3 AMPLITUDE	Window 3 MOD%
Ref	150	100	150	100
33'	130	87	130	87
16.5'	50	33	55	37
11'	28	19	30	20
8'	10	7	35	23
6.5'	10	7	20	13
5.5'	4	3	8	5
4.5'	0	0	0	0

(c) Horizontal modulation depth of large raster at window center.

ANGULAR RES	Window 3 AMPLITUDE	Window 3 MOD%	Window 6 AMPLITUDE	Window 6 MOD%
Ref	90	100	100	100
66	100	111	90	90
33	40	44	45	45
22	27	30	35	35
16	33	37	18	18
13	22	24	18	18
11	12	13	10	10
9	0	0	0	0

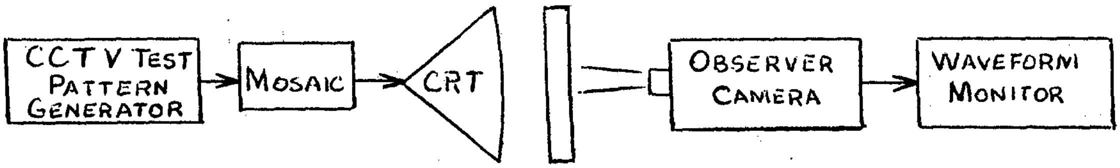
(d) Horizontal modulation depth of large raster near tri-joint 2, 3, and 6.

ANGULAR RES	Window 3 AMPLITUDE	Window 3 MOD%	Window 6 AMPLITUDE	Window 6 MOD%
Ref	125	100	100	100
66	105	84	85	85
33	40	32	85	85
22	20	16	68	68
16	12	10	48	48
13	10	8	50	40
11	6	5	32	32
9	0	0	0	0

g. <u>Display Brightness, Gray Scale, Contrast, Shading</u>

(1) Test Method: Photometer

A test pattern shall be displayed which includes a gray scale, peak white, and peak black targets. The video shall have a 50% APL. A photometer shall be located at the pilot's eyepoint and shall be used to measure peak picture brightness, black picture brightness, brightness of each gray step, contrast ratio, and picture shading.



(2) Data Required

(a) Measure brightness of each step of a 10 step gray scale at the center of the AOI with the AOI centered in the forward window, background off.

(b) Measure gray scale brightness as in step (a) with the background set to each of its four levels of gray.

(c) On the 50% APL background of the gray scale, measure brightness at the center and each corner of the AOI with the AOI centered in the forward window, STG background off.

(d) With the pattern generator connected to the large raster, measure the brightness of each step of the gray scale at forward window center.

(e) On the 50% APL background of the gray scale, measure brightness at the center and each corner of the forward window.

(f) Repeat steps (a), (c), (d), and (e) on a second window.

h. <u>Display Brightness, Gray Scale, Contrast Shading Results</u>

(1) Test Method

The camera video had been set to have a relatively high pedestal. When the pattern generator was substituted for the camera, the first two steps of the gray scale were too far below the pedestal to be visible in the small raster. Also, the unique timing of the SAAC system made the 50% APL background of the gray scale on the Vii generator unusable for shading measurements. The 50% APL flat field was obtained by using the resolution output adjusted near the limiting resolution of the display. A 1° aperture was used on the photometer to average the resolution lines.

(2) Data

(a) Brightness of each step of a 10-step gray scale at the center of the AOI. No scan lines were visible for steps 1 and 2. The readings entered for step 2 represent extraneous light from the step 2 location. Step 10 (reference paragraph 3v Test Sequence, Photometer) was eliminated by system blanking.

STEP	WINDOW 2	WINDOW 3	WINDOW 6
1	-	-	-
2	.090	.054	.038
3	.109	.084	.054
4	.271	.213	.134
5	.527	.447	.262
6	.867	.827	.480
7	1.226	1.130	.754
8	1.693	1.386	1.086
9	3.13	1.596	1.349
10	-	-	-

(b) Shading in the AOI on a 50% APL flat field with the AOI centered in the window.

LOCATION	WINDOW 2	WINDOW 3	WINDOW 6
Center	.144	.130	.0998
Upper right	.178	.144	.0955
Upper left	.100	.132	.0932
Lower right	.195	.140	.0970
Lower left	.090	.129	.0864

(c) Brightness of each step of a 10-step gray scale in the large raster.

STEP	WINDOW 2	WINDOW 3	WINDOW 6
1	.089	.017	.101
2	.143	.074	.177
3	.203	.119	.134
4	.327	.236	.285
5	.517	.417	.434
6	.807	.477	.589
7	1.162	.683	.718
8	.779	.942	.911
9	1.13	1.070	1.226
10	1.874	1.153	1.335

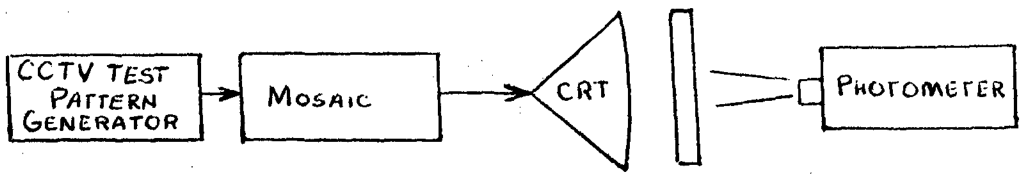
(d) Shading in the large raster on a 50% APL flat field.

WINDOW 2		WINDOW 3		WINDOW 6	
Location	Brightness	Location	Brightness	Location	Brightness
Center	.818	Center	.778	Center	.707
2-3-6	.850	3-6-7	.534	1-2-6	.650
1-2-6	.903	2-3-6	.839	2-3-6	.592
Low Left	.425	3-4-7	.839	6-7-8	.762
Low Right	.834	Low Left	.640	1-6-8	.492
Bottom	.456	Low Right	.808	3-6-7	.495

i. System Brightness, Gray Scale, Contrast, Shading

(1) Test Method: Photometer

The gantry camera shall be set up to view a test pattern as discussed in Test h.



(2) Data Required

(a) Measure brightness of each step of a 10-step gray scale at the center of the AOI with the AOI centered in the forward window, background off.

(b) With the camera probe viewing an 18% reflectance gray card on the model board, measure brightness at the center and each corner of the AOI.

(c) Slew the AOI and measure the brightness at each corner of the forward window.

(d) Measure brightness of each of the four gray shades of the STG background.

j. <u>System Brightness, Gray Scale, Contrast, Shading Results</u>

(1) Test Method: As planned.

In addition, photometer readings were taken at the model board on the light box gray scale and on the card used for shading measurements.

(2) Data

(a) Brightness of each step of a 10-step gray scale in the AOI with the AOI centered in the window.

<u>1</u>. In the display (from left side gray scale) (foot lamberts).

STEP	WINDOW 3	WINDOW 6
1	1.045	.281
2	1.121	.315
3	1.220	.346
4	1.213	.392
5	1.309	.481
6	1.405	.637
7	1.520	.943
8	1.717	1.172
9	3.36	1.321
10	3.80	1.340

<u>2</u>. At the light box (foot lamberts).

STEP	UPPER	LOWER	RIGHT	LEFT
1	1.265	1.14	1.10	1.73
2	7.72	5.68	5.48	6.23
3	16.99	16.21	17.68	16.66
4	27.8	27.5	28.6	27.3
5	41.7	39.7	41.9	40.0
6	61.5	56.8	60.6	57.3
7	86.9	80.9	85.1	84.1
8	103.8	98.1	103.2	102.8
9	117.6	112.7	115.6	118.2
10	124.8	121.6	123.4	125.6

3. In the video. These measurements were made by observing the video level of each gray scale step on a Tektronix oscilloscope. Readings in facyslate divisions with blanking set at 0.

STEP	AT CAMERA OUTPUT Mon Night	Wed Night	AT DISPLAY INPUT Mon Night
1	0	2.7	0
2	.2	2.8	0
3	.6	3.0	.1
4	1.0	3.2	.25
5	1.6	3.45	.6
6	2.5	3.9	1.5
7	3.6	4.3	2.9
8	4.4	4.7	4.0
9	5.0	5.1	5.0
10	5.4	5.3	5.5

(b) Shading in the AOI. A 90% reflectance card was used instead of the planned 18% to help make up for the fact that there was less light on the card than would ordinarily be used on the model board.

1. In the display. Two readings were taken in each corner on the left side of the AOI to indicate the magnitude of the video ripple which occurred there (foot lamberts).

LOCATION	WINDOW 2	WINDOW 3	WINDOW 6
Center	2.87	2.76	1.82
Upper Right	2.18	2.04	1.25
Lower Right	4.98	4.08	2.44
Upper Left	2.21/1.84	2.11/1.67	2.07/1.89
Lower Left	2.27/2.02	2.91/2.51	1.19/1.00

2. Brightness of the 90% reflectance card (foot lamberts).

Center	27.6
Upper Right	22.5
Lower Right	29.0
Upper Left	23.95
Lower Left	30.1

(c) STG brightness in window 3.

	Originally	Readjusted Pedestal
Shade 1	.1576	.128
Shade 2	.231	.235
Shade 3	.460	.407
Shade 4	.707	.621
Sky	1.251	1.238
Sun	8.04	8.55

k. System Geometric Distortion and AOI Field of View

(1) Test Method: Theodolite

A linearity test pattern shall be viewed by the system image generator camera. A theodolite shall be located at the pilot's eyepoint and shall be used to measure field of view and display linearity.

Block Diagram

Same as test i except that a theodolite is used in place of the photometer.

(2) Data Required

(a) With the AOI centered in the forward window, measure angles to the edges and corners of the AOI.

(b) Measure angles to 36 data points at the intersections of a six-by-six square crosshatch pattern.

(c) Repeat step (b) in a second window.

l. System Geometric Distortion and AOI Field of View Results

(1) Test Method

Measurements were taken as planned except for taking them from only one window instead of two. The second window appeared to be redundant.

(2) Data

The test chart viewed by the camera had the following appearance.

POINT	AZ	EL	POINT	AZ	EL
1	341°47'	19°33'	19	342°8'	-3°7'
2	348°33'	20°20'	20	348°50'	-3°5'
3	355°47'	20°30'	21	356°10'	-3°0'
4	3°2'	20°15'	22	3°30'	-2°53'
5	10°30'	19°28'	23	10°28'	-2°40'
6	76°52'	18°28'	24	16°59'	-2°33'
7	341°49'	12°31'	25	342°23'	-10°47'
8	348°34'	12°50'	26	348°53'	-10°47'
9	355°47'	13°5'	27	356°7'	-10°46'
10	3°6'	13°0'	28	3°37'	-10°30'
11	10°14'	12°33'	29	10°22'	-10°14'
12	16°38'	11°57'	30	16°42'	-9°48'
13	340°55'	4°35'	31	342°4'	-17°35'
14	349°0'	4°55'	32	348°52'	-17°48'
15	355°52'	5°5'	33	356°9'	-16°0'
16	3°21'	5°12'	34	3°30'	-16°5'
17	10°23'	5°3'	35	10°10'	-15°58'
18	16°53'	4°35'	36	16°20'	-16°22'

m. <u>System Interwindow Continuity</u>

(1) Test Method: Theodolite

A linearity test pattern shall be viewed by the system image generator camera, and the AOI shall be centered on the joint between two windows. A theodolite shall be located at the pilot's eyepoint and shall be used to measure discontinuity across the joint.

Block Diagram: Same as Test k

(2) Data Required

(a) Measure angles to a selection of points on each side of the window joint.

(b) Repeat along two or more additional joints.

n. <u>System Interwindow Continuity Results</u>

(1) Test Method

The AOI displaying the same checkerboard pattern as for test 1 was positioned over tri-joint 2-3-6. Distortion is worst at the tri-joints and the system engineers state that all joints are essentially the same. Tri-joint 2-3-6 is the one most frequently in the pilot's view.

(2) Data

POINT	AZ	EL	POINT	AZ	EL
1	299°35'	23°45'	20	304°35'	0°20'
2	305°55'	24°35'	21	311°30'	0°14'
3	311°53'	24°35'	22	318°30'	0°15'
4	320°20'	23°45'	23	325°20'	0°23'
5	326°55'	21°47'	23*	325°16'	0°23'
6	332°7'	19°40'	24	332°46'	0°25'
7	298°9'	16°25'	25	298°15'	-6°46'
8	305°9'	17°20'	26	304°35'	-7°20'
9	312°3'	17°38'	27	311°28'	-7°31'
10	319°4'	17°1'	28	318°35'	-7°20'
11	325°35'	15°43'	29	325°13'	-6°50'
12	331°5'	14°27'	30	331°45'	-6°28'
13	298°50'	8°30'	31	298°15'	-13°22'
14	304°58'	8°25'	32	304°30'	-14°7'
15	311°55'	8°25'	33	311°25'	-14°23'
16	318°50'	8°27'	34	318°25'	-14°10'
17	314°38'	8°6'	35	325°4'	-13°20'
18	332°12'	7°37'	36	329°59'	-12°13'
19	298°12'	0°45'	36*	330°58'	-12°25'

*NOTE: Points 23 and 36 appeared at two locations in adjacent windows. The above readings were taken with small raster oriented to have horizontal scan lines. An attempt was made to rotate the AOI 90° to make the scan lines vertical then repeat the readings. The rotation was very difficult to accomplish and the attempt was dropped, but it was noted that with the raster rotated about 45°, one point (No. 14) appeared in adjacent windows at azimuths 315°15' and 311°30'. Elevation was the same for both locations.

o. AOI Edge Transition Quality

(1) Test Method: Observer Camera

A uniform flat field shall be displayed in the AOI. An observer camera shall be used to measure the transition between the AOI and the background image.

Block Diagram: Same as Test c.

(2) Data Required

(a) Measure rise time of edge transition at all four edges of the AOI with the AOI centered in the forward window, background off.

(b) Repeat test with the background set to each of the four gray levels of the STG.

p. <u>AOI Edge Transition Quality Results</u>

(1) Test Method

Experience on an earlier test indicated that measuring edge transition with the observing camera was very difficult. For this test, we switched to using the photometer aperture as a gauge of edge transition.

(2) Data

No attempt had been made to feather the edges of the AOI. The transition from black to white at each end of a scan line occurred in about twice the diameter of the 2' aperture of the Spectra photometer. At top and bottom of the raster the first or last scan line appeared at full signal level.

q. <u>Camera Gantry Rate Accuracy</u>

(1) Test Method: Stop Watch

Simulated velocity shall be checked by timing the gantry as it moves between points a known distance apart.

(2) Data Required

(a) At a simulated aircraft speed of 300 knots, measure gantry travel time between two points 6 ft. 1 in. apart (4 nautical miles). Measure for travel in both directions with the probe traveling parallel to the long dimension of the model board.

(b) Repeat with the probe traveling parallel to the short dimension of the model board.

r. <u>Camera Gantry Rate Accuracy Results</u>

(1) Test Method: As planned.

(2) Data

Travel at a simulated 300 knots over a simulated 4 nautical miles. Time interval should be 48 seconds.

DIRECTION	TIME
X	45.6 sec.
-X	45.8 sec.
Y (probe down)	47.7 sec.
-Y (probe up)	48.3 sec.

s. TMB/Optical Mosaic System Design Data

(1) In contrast to the other Air Force systems or Navy system evaluated during this project, the TMB/Optical Mosaic system required extensive one-time modification and integration. Therefore the following data in this paragraph was collected during Phase I. Design data for the other systems is available through appropriate channels and therefore not published herein.

(a) Display Collimation

(b) AOI FOV

(c) Display FOV map

(d) Excursion limits for AOI pitch, yaw, and altitude

(e) Gaming area

(f) Maximum rates and static accuracy of system display of pitch, roll, yaw, X, Y, and Z.

t. System Design Data Results

(1) Display Collimation

Since Collimation data was not available, we measured the collimation of window 3 as representative.

(a) Test Method: Parallel Telescope

We calibrated the parallel telescope by observing a water tower at a distance of about 1/2 mile. Assuming this distance to be essentially infinity, we aligned the graticules in the two telescopes. This assumption will result in a maximum error of about 18 arc seconds. The angle per division in the right telescope was calibrated by observing two points 11.5 inches apart from a distance of 166.5 feet. The points spanned 9 divisions in the telescope indicating that each division is about 2.3 arc minutes. In the cockpit, the left telescope was aligned with a point in the display, and the location of the same point in the right telescope was recorded in divisions right or left of center. A reading to the right of center indicates that the point appears nearer than infinity. (The image in the telescope is inverted.) Spacing between the telescopes was 70 min.

(b) Data

LOCATION IN WINDOW 3	IMAGE DISPLACEMENT
Center	0
Corner 2-3-6	1 Right
Low Left	2 Right
Low Right	2 Right
Corner 3-4-7	3 Right
Corner 3-6-7	0

One additional measurement was made at the center of window 6 with a reading of 0.

(2) AOI FOV

The AOI for SAAC/F-4E No. 18 was 40° by 40°.

(3) Display FOV Map

Total FOV is approximately ±148° horizontal by +150° -30° vertical.

(4) Excursion Limits for AOI Pitch, Roll, Yaw, and Altitude

Pitch, roll, and yaw of the AOI (as distinguished from the probe) are unlimited. The AOI may be positioned anywhere within the total FOV with any orientation. The limits for the model board probe are as follows:

Pitch: +15° to -55° (only negative pitch was used for this project)

Roll: Unlimited, but not used for this project

Yaw: Unlimited

Altitude: 10,000 feet

(5) Gaming Area

The original 1500:1 model board measures 16 X 44 feet. For this project, an 8 X 16 foot area was rescaled to 4000:1. The area around the new portion was sufficiently undetailed to consider it 4000:1. The total area which could be considered 4000:1 was 16 X 20 feet for a gaming area of 10.5 X 13 nautical miles. If scaling is ignored, the total board represents a gaming area of 10.5 X 29 nautical miles.

(6) Maximum rates and static accuracy of system display of pitch, roll, yaw, X, Y, and Z.

	Max Rate	Static Accuracy
Pitch	495°/sec	
Roll	227°/sec	± 18'
Yaw	86°/sec	± 9'
X	1480 ft/sec	± 0
Y	1480 ft/sec	± 0
Z	1333 ft/sec	± 0

u. <u>Image Generation Dynamic Resolution/MTF Results</u>

(1) Test Method: Video Signal Analysis

A dynamic resolution test had been run on the model board camera before it was sent to Luke AFB. Therefore, no test had been planned at Luke. However, operating conditions at Luke were sufficiently different to warrant inclusion of this test. The probe at aero pitch was positioned to view a resolution pattern placed on the model board extender mirror. Heading was then slewed at a constant rate and the camera video output observed on an oscilloscope. The resolution pattern had eight TV lines/inch.

(2) Data

(a) Probe distance 11.5 inches (37 arc minutes/TV line), reference amplitude 2.4 cm.

RATE	AMPLITUDE (CM)	MOD %
2°/sec	2	83
4°/sec	1.8	75
12°/sec	1.5	62
16°/sec	1.3	54
20°/sec	1.2	50
28°/sec	1.2	50
40°/sec	.8	33
60°/sec	.4	17
80°/sec	.2	8
120°/sec	-	

(b) Probe distance 18 inches (24 arc minutes/TV line), reference amplitude 2.7 cm.

RATE	AMPLITUDE (CM)	MOD %
0°/sec	2.0	74
2°/sec	2.0	74
8°/sec	1.9	70
20°/sec	1.5	56
30°/sec	1.2	44
40°/sec	1.0	37
50°/sec	.8	30
60°/sec	.6	22
70°/sec	.5	19
80°/sec	.4	15
100°/sec	-	-

(c) Probe distance 36 inches (12 arc minutes/TV line), reference amplitude 3.2 cm.

RATE	AMPLITUDE (CM)	MOD %
0°/sec	1.2	38
2°/sec	1.2	38
6°/sec	1.0	31
10°/sec	.6	19
16°/sec	.4	13
24°/sec	.3	9
40°/sec	-	-

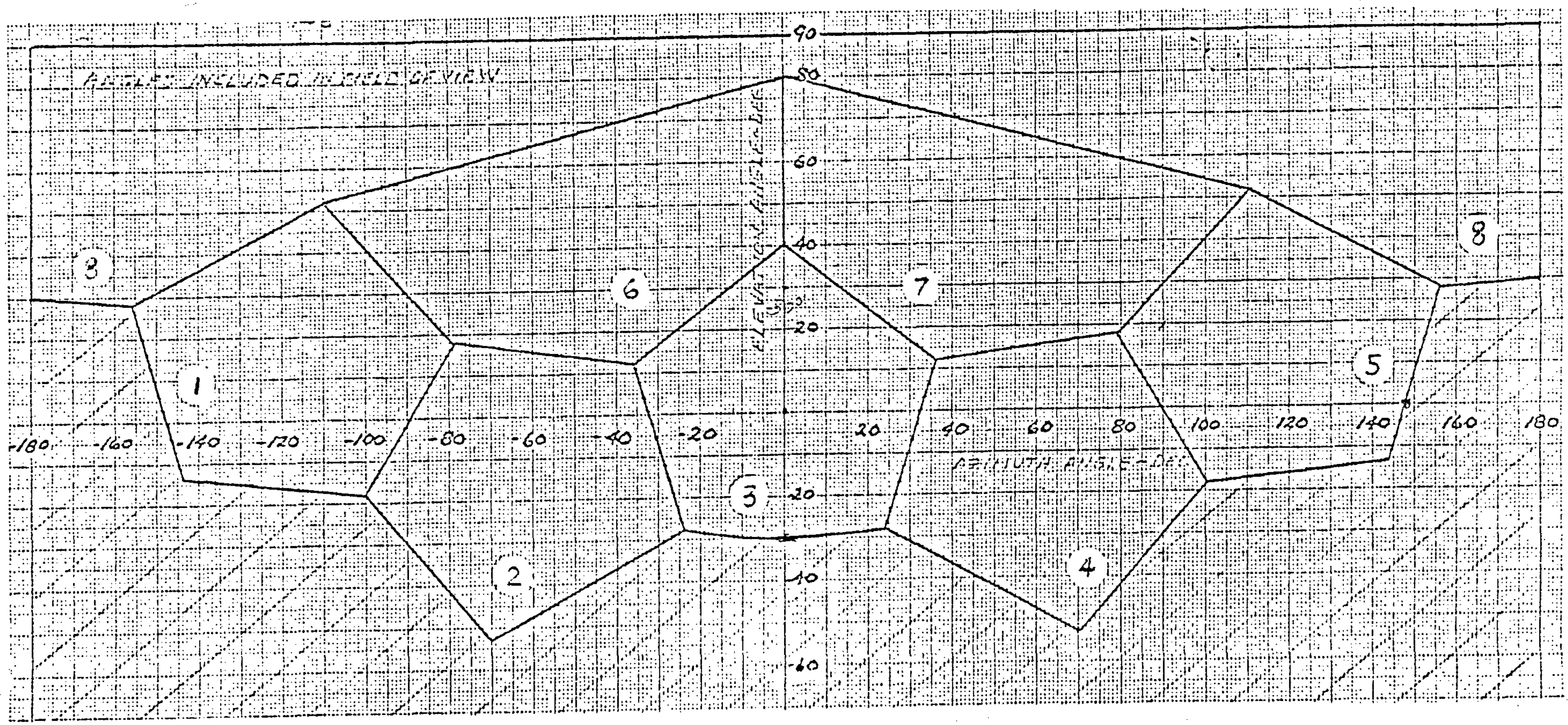


FIGURE I-12 SAAC WINDOW NUMBERING SYSTEM

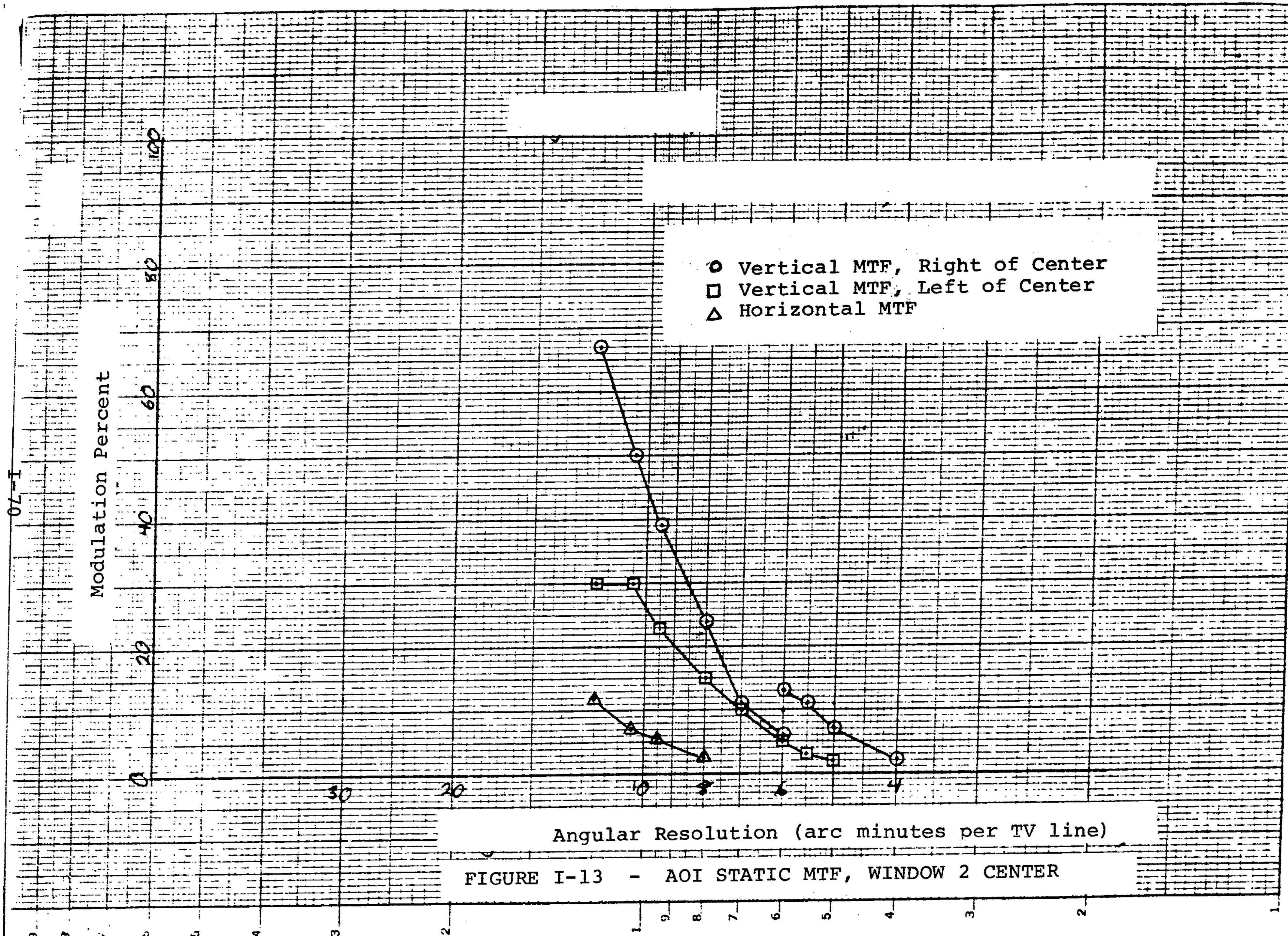


FIGURE I-13 - AOI STATIC MTF, WINDOW 2 CENTER

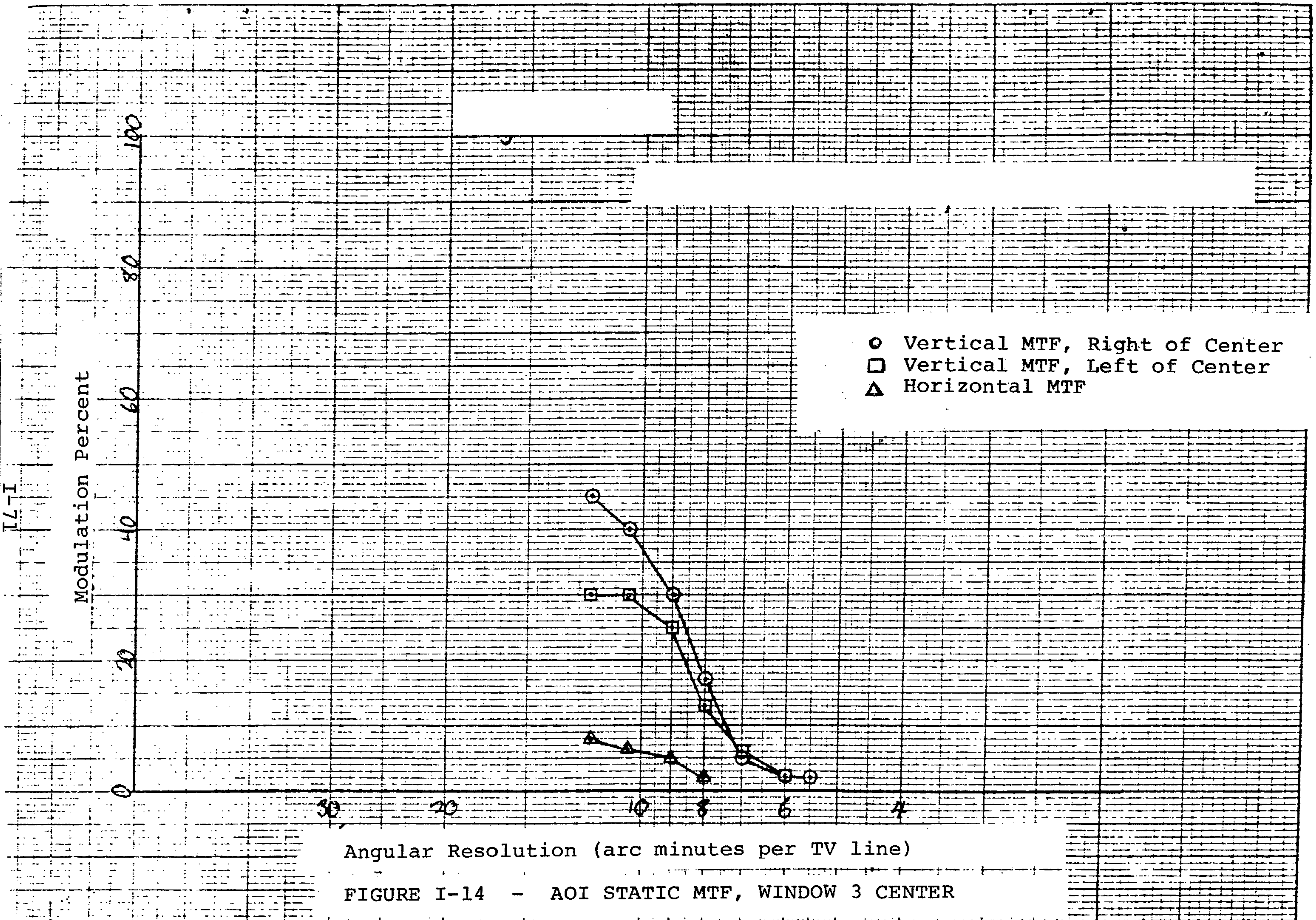


FIGURE I-14 - AOI STATIC MTF, WINDOW 3 CENTER

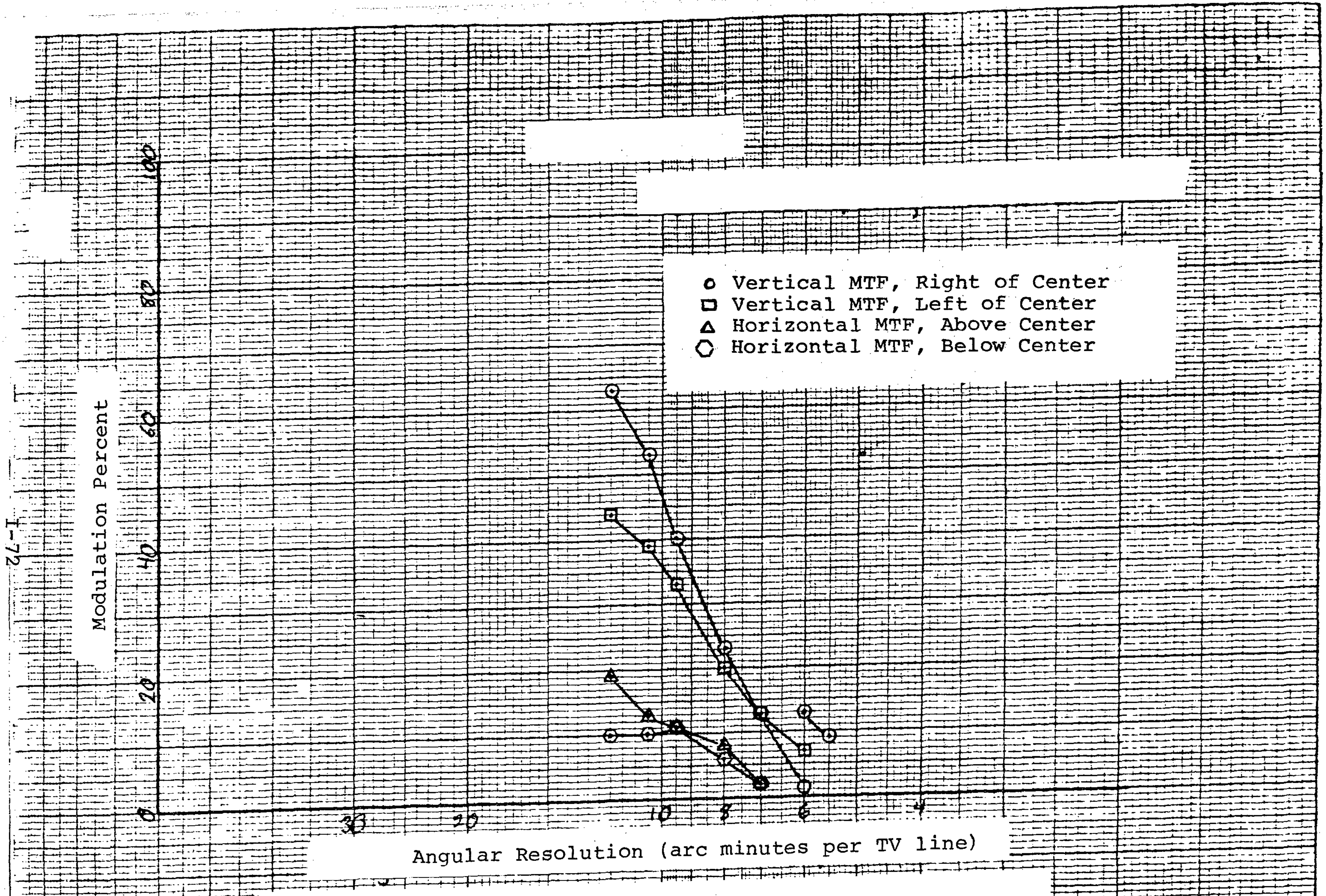


FIGURE I-15 - AOI STATIC MTF, WINDOW 6 CENTER

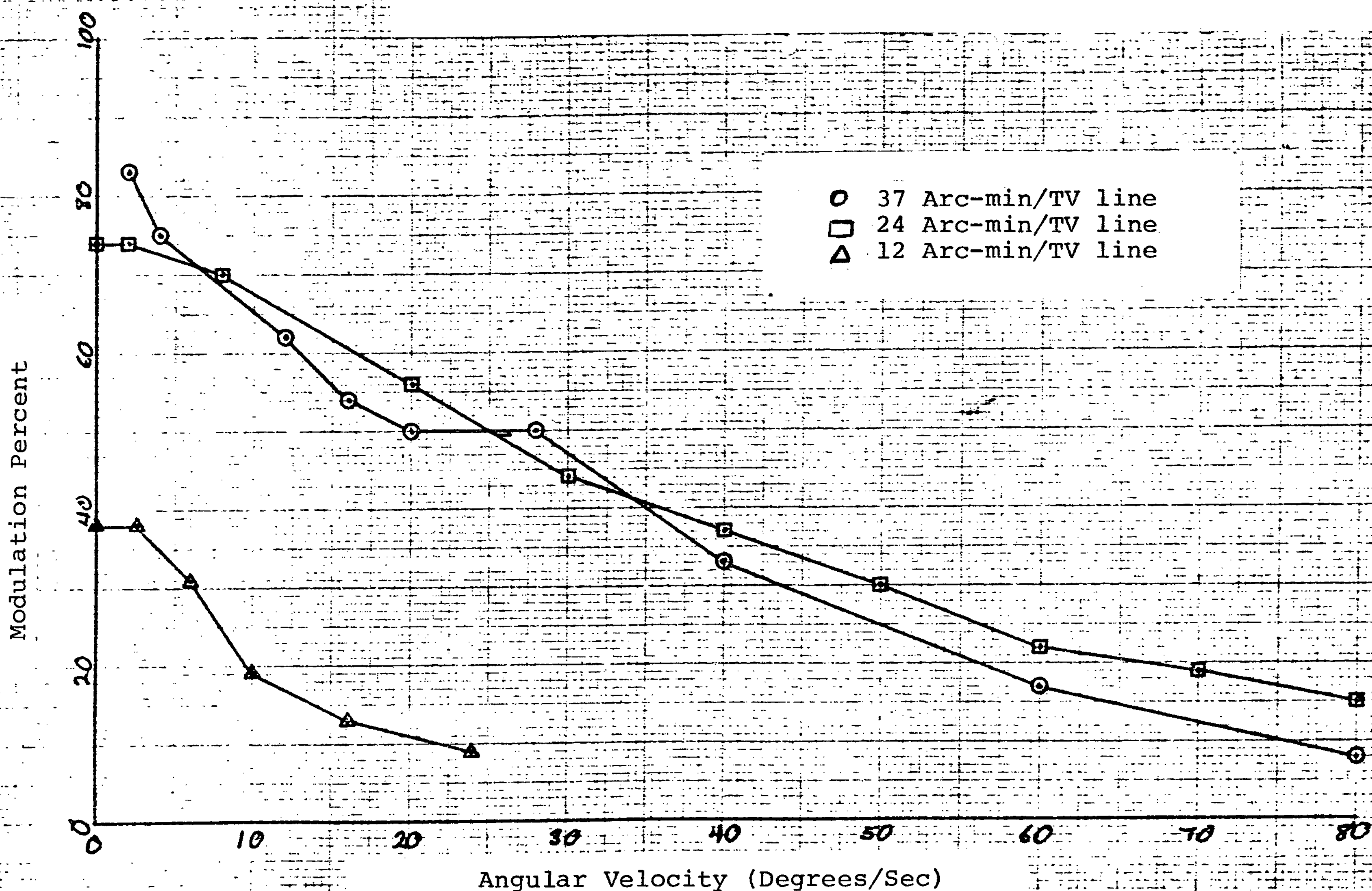


FIGURE I-16 - IMAGE GENERATOR DYNAMIC RESOLUTION

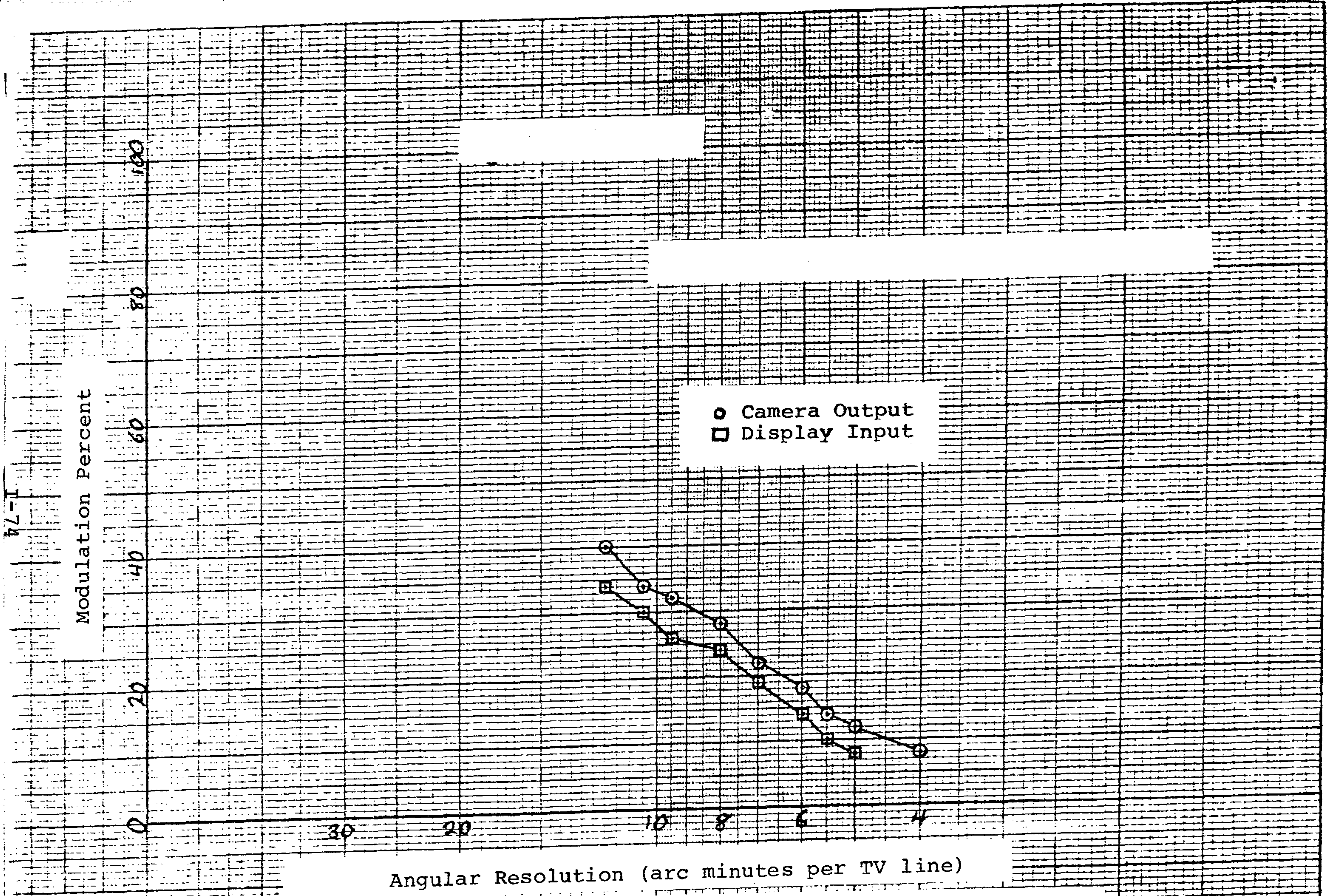


FIGURE I-17 - MODULATION TRANSFER IN THE VIDEO

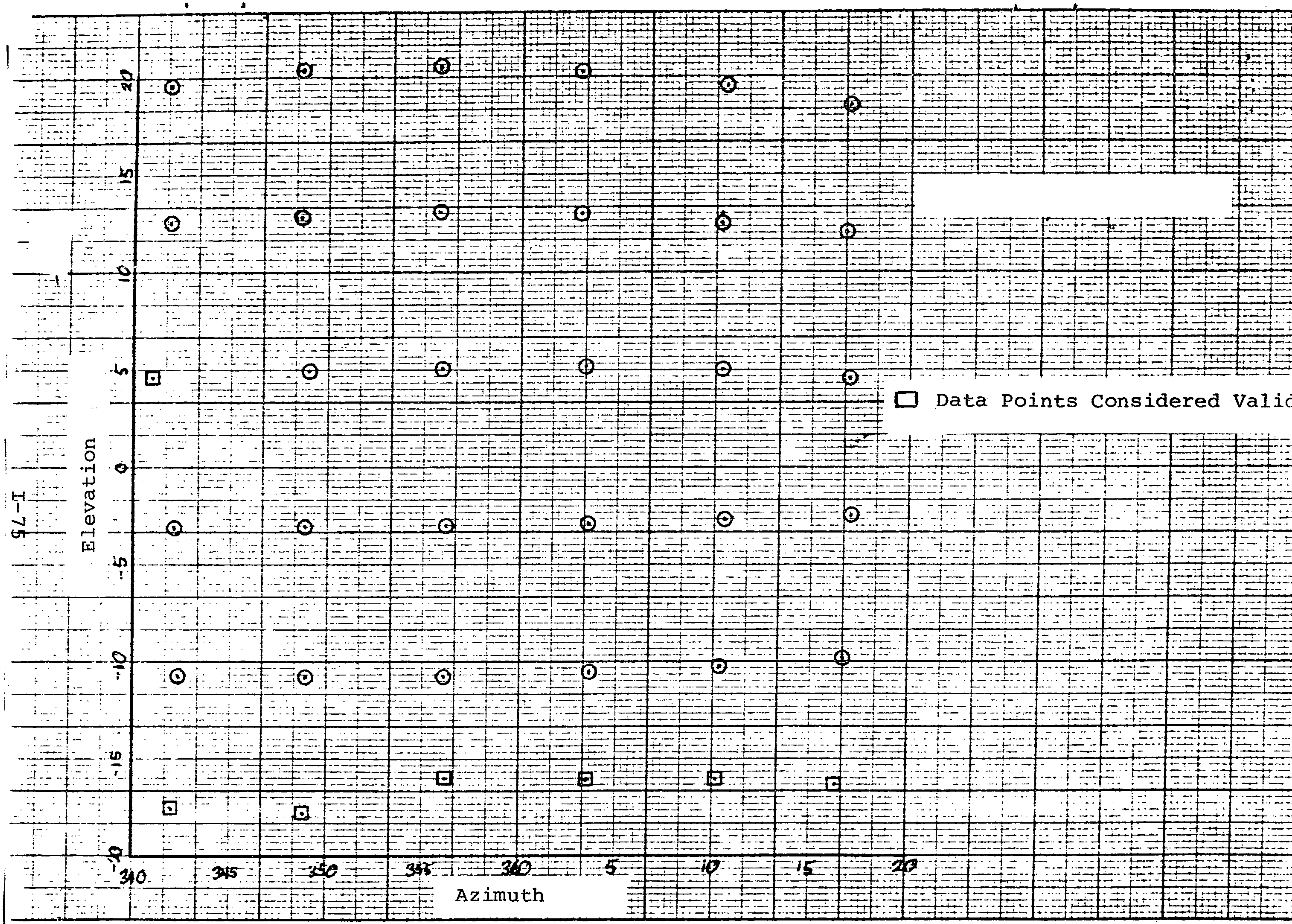


FIGURE I-18 - LINEARITY, WINDOW 3

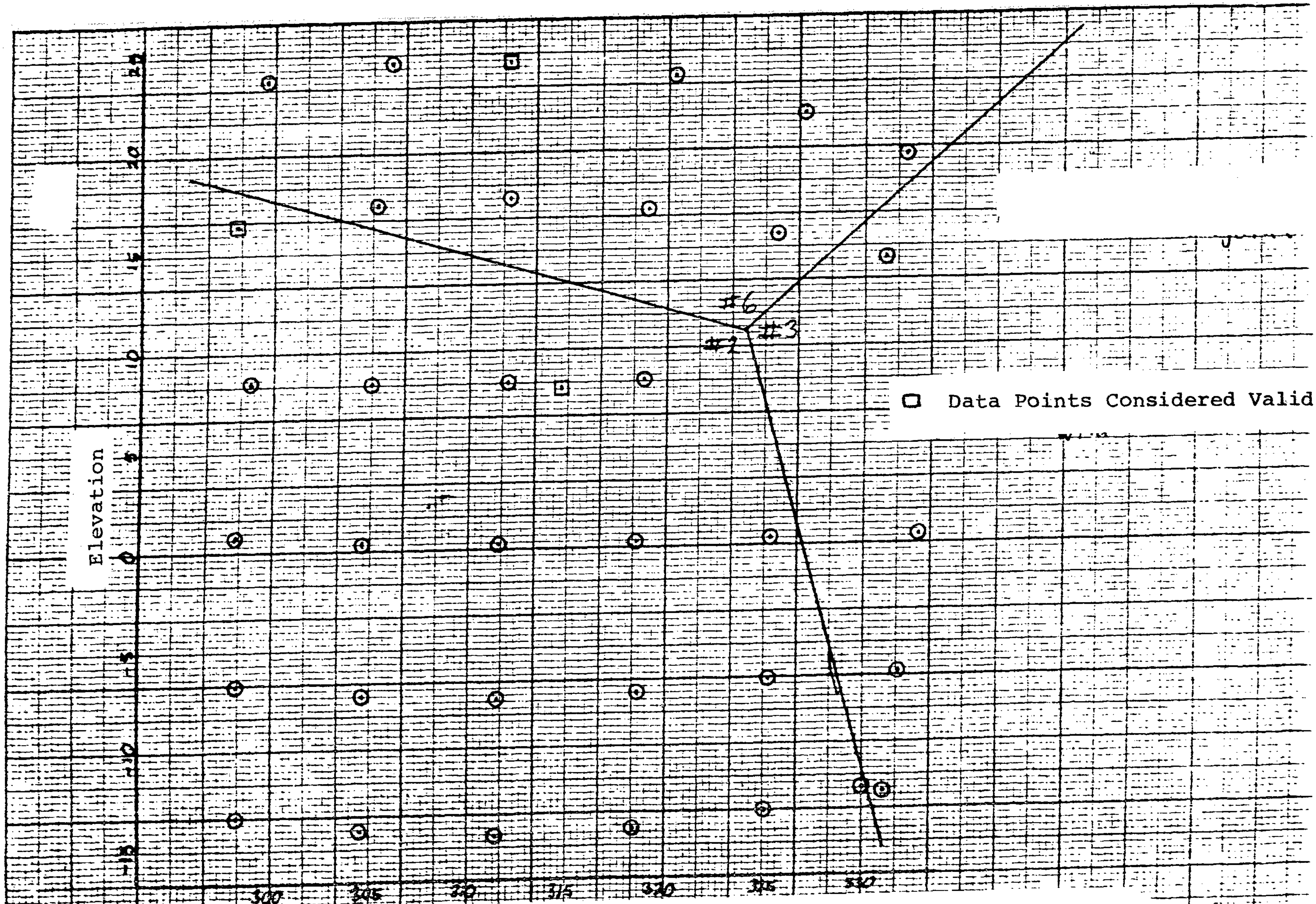


FIGURE I-19 - LINEARITY AND CONTINUITY, 2-3-6 TRI-JOINT

v. Test Sequence

To minimize the need to repeatedly switch equipment in the cockpit, data should be collected in the following order:

(1) Theodolite

Step 1: Install theodolite in cockpit at the pilot's nominal eyepoint and align with aircraft coordinates.

Step 2: Position linearity chart and camera probe for full AOI display of the chart.

Step 3: Slew the AOI to the center of the forward window.

Step 4: Measure azimuth and elevation angles to data points in AOI, including edges and corners.

Step 5: Slew the AOI to the center of a second window.

Step 6: Repeat step 4.

Step 7: Slew the AOI to straddle a window joint.

Step 8: Measure angles to a selection of points on each side of the joint.

Step 9: Repeat on additional joints.

Step 10: Replace linearity chart with resolution chart.

Step 11: Slew AOI to center of front window.

Step 12: Measure resolution of coarsest part of center resolution wedge.

Step 13: Connect pattern generator to provide input to AOI and set it to 100 line resolution with resolution content fully counterclockwise (coarsest setting).

Step 14: Measure resolution with theodolite.

Step 15: Check resolution at least one other generator setting.

(2) Observer Camera

Step 1: Replace theodolite with observer camera.

Step 2: Measure modulation depth in display from reference setting to limiting resolution.

Step 3: Slew AOI to position one corner of AOI in a corner of the forward window.

Step 4: Measure modulation depth at corner of forward window.

Step 5: Slew AOI to center of second window.

Step 6: Measure modulation depth at center of AOI.

Step 7: Return AOI to center of forward window. Turn on STG background and position a field with the darkest shade of gray behind the AOI.

Step 8: Measure modulation depth at the center of the AOI.

Step 9: Repeat modulation depth measurements with the other three STG gray shades backing the AOI.

Step 10: Connect pattern generator to provide video to the large raster on the forward window.

Step 11: Measure modulation depth at center of forward window.

Step 12: Measure modulation depth at a corner of forward window.

Step 13: Replace linearity chart with resolution chart in light box and reconnect camera video to the AOI.

Step 14: Measure horizontal modulation depth at AOI center.

Step 15: Measure horizontal modulation depth at a corner of the AOI.

Step 16: Slew the AOI to position a corner of the AOI in a corner of the forward window.

Step 17: Measure horizontal modulation depth in that corner.

Step 18: Position the AOI at the center of a second window.

Step 19: Measure horizontal modulation depth at AOI center.

Step 20: Position a corner of the AOI in a corner of the second window.

Step 21: Measure horizontal modulation depth in that corner.

Step 22: Measure vertical modulation depth in that corner.

Step 23: Return AOI to the center of the second window.

Step 24: Measure vertical modulation depth at the center of the AOI.

Step 25: Position AOI as in step 16.

Step 26: Measure vertical modulation depth in that corner.

Step 27: Position AOI in center of forward window.

Step 28: Measure vertical modulation depth at the center of the AOI.

Step 29: Measure vertical modulation depth at a corner of the AOI.

Step 30: Connect oscilloscope in line-finder mode to monitor video going to the AOI.

Step 31: Measure modulation depth in the video at the center of the AOI.

Step 32: Measure modulation depth in the video at a corner of the AOI.

Step 33: Set camera probe to view 18% gray card on the model board.

Step 34: Measure rise time in the observer camera video as it views each of the four edges of the AOI.

Step 35: Turn on STG and position darkest gray field behind the AOI. Repeat step 34.

Step 36: Measure edge transitions for each of the other four STG gray shades.

(3) Photometer

Step 1: Install photometer at the pilot's eyepoint.

Step 2: With STG off, measure brightness at the center and each corner of the AOI.

Step 3: Slew the AOI and measure the brightness at each corner of the forward window.

Step 4: Replace the gray card with a 10-step gray scale.

Step 5: Position AOI in center of forward window and measure brightness of each step of the gray scale.

Step 6: Connect pattern generator to AOI video and set it for gray scale with 50% APL background.

Step 7: Measure brightness of each step of the gray scale.

Step 8: Measure brightness of 50% APL background at center and each corner of the AOI.

Step 9: Turn on STG and measure brightness of each step of the 10-step gray scale with the AOI backed successively by each of its four shades of gray.

Step 10: Slew AOI as needed and measure brightness of each corner of the forward window on the 50% APL background of the AOI (STG off).

Step 11: Position AOI in center of second window and measure brightness of each step of 10-step gray scale.

Step 12: Measure brightness of 50% APL background at center and each corner of the AOI.

Step 13: Slew the AOI to measure brightness on 50% APL background at each corner of second window.

Step 14: Connect the pattern generator to the large raster of the second window.

Step 15: Measure brightness of each step of the 10-step gray scale at the center of the second window.

Step 16: Measure brightness of the 50% APL background at the center and each corner of the forward window.

Step 17: Connect the pattern generator to the large raster on the forward window.

Step 18: Measure brightness of each step of the gray scale at the center of the forward window.

Step 19: Measure brightness of the 50% APL background at the center and each corner of the forward window.

Step 20: Set the computer to store and print out the flight coordinates X, Y, Z, roll, pitch, yaw upon the occurence of a trigger. Connect the photometer meter output to this trigger input.

Step 21: Set the model board for night visual and select a bright isolated light. Align the photometer with that light as presented in the display and record the coordinates X, Y, Z, roll, pitch, yaw.

Step 22: Back off and fly a path that brings the aircraft through the previous coordinates. Record the triggered coordinates as printed out by the computer.

Step 23: Repeat step 22 for several flight paths involving various velocities, dive angles, roll velocities.

(4) Stopwatch

Step 1: On the camera gantry, mark points six feet one inch apart for both vertical and horizontal camera travel.

Step 2: Fly a simulated 300 knots between the marked points and record the time of passage. Should be 48 seconds.

Step 3: Fly in both directions between both sets of points.

(5) Equipment Required

Step 1: Modified Diamond observer camera.

Step 2: 200mm, f 3.5 lens for observer camera.

Step 3: 75mm, f 1.4 lens for observer camera.

Step 4: Kern DKM 1 theodolite.

Step 5: Tektronix 453 oscilloscope or equivalent.

Step 6: Tektronix 529 waveform monitor.

Step 7: Sony PVJ-3040 CCTV monitor.

Step 8: Light box.

Step 9: Resolution chart for high resolution video.

Step 10: Visual information institute pattern generator (Harschbarger's box).

Step 11: Pritchard photometer.

Step 12: Gray scale chart.

Step 13: Kodak 18% reflectance gray card.

Step 14: Stop watch.

SECTION II

PHASE II DATA

The following pages include the Briefing Guides/ Mission Scenarios and sample questionnaires used during Phase II (Operational) Evaluations. The Briefing Guides/ Mission Scenarios serve as both a record of the sequencing of missions for each device, and the scenario contents. The number of questionnaires included below are not the complete number of questionnaires used. To include every questionnaire would be impractical, the ones contained herein are representative samples.

BRIEFING GUIDE - ASUPT

Use this guide to brief and control each mission.

1. During the mission, evaluate the tasks and references as listed on the appropriate analysis form for the respective mission. Record as many of the pilot's comments on the Mission Remarks Log as time will allow. Insure that the tape recorder is operating. Maintain the Weapons Log, if applicable.

2. At the completion of the mission, the pilot, briefer, and technical representative will debrief the mission. Use the notes and recording obtained during the mission, as appropriate. Discuss the inflight comments and derived opinions sufficiently so that the technical representative fully understands any issues that may subsequently arise. The technical representative has been instructed to have limited participation in this briefing so that the pilots will continue to offer original opinions concerning the visual scene.

3. After the debriefing, the pilot will complete the debriefing questionnaire for the mission just flown.

4. Give all paperwork to the Phase II manager.

ASUPT 1

a. Time: 90 minutes

b. Cockpit: B only with right seat support

c. Motion: On

d. Initialization: Runway; WX Cat A; Winds Calm

e. Flight Area: Airfield Complex

f. Purpose: Familiarization with simulator flight characteristics and visual presentations. Pilot should be able to fly the simulator at the completion of this sortie.

g. Description	Time Guide
Takeoff, depart the pattern area. Fly the aircraft and obtain a feel for the controls and instrumentation. Select ground references for airwork and aerobatic tasks.	+ 20
Perform lazy eights, chandelles, slow flight, stalls, spins, and a vertical recovery.	+ 40
Change to WX Cat B and perform aileron roll, barrel roll, cloverleaf, loop, immelmann, split-s, and cuban eight.	+ 60
Return to the airfield and perform a straight-in approach, low approach, and missed approach. Re-enter initial and fly multiple VFR overhead and closed patterns with touch-and-go and full stop landings (at least two of each).	+ 90

a. Time: 90 minutes

b. Cockpit: B only

c. Motion: On

d. Initialization: Runway; WX Cat A, Winds Calm

e. Flight Area: Conventional Gunnery Range

f. Purpose: Familiarization with the conventional range. Pilot should be able to operate on the gunnery range at the end of this sortie.

g. Description	Time Guide
Takeoff, depart the airport area, and fly to the conventional range. Fly down the range road, survey the environment, and perform a left break to downwind over the range tower.	+ 20
Fly a normal box pattern and perform the events listed below approximately five or six times each. For each event, fly the entire pattern twice and then use the simulator reset function an additional three or four times:	
Low Angle Strafe 10° Skip (on the box) Low Level Bomb	+ 40
15° Low Angle Bomb 30° Dive Bomb 30° High Angle Strafe	+ 60
45° Dive Bomb (extend pattern to gain altitude) 60° Dive Bomb (extend pattern to gain altitude)	
Use the remainder of the time to practice low angle events.	+ 80
Reinitialize three miles on runway final approach and perform a crosswind (10 knots) landing using WX Cat C.	+ 90

ASUPT 3

a. Time: 45 minutes

b. Cockpit: B only

c. Motion: 50% On - 50% Off (Random)

d. Initialization: Conventional Range; WX Cat B; 10 Knot Crosswind

e. Flight Area: Conventional Range

f. Purpose: Analyze low angle events on the conventional range. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of low angle weaponry tasks.

g. Description	Time Guide
Use the reset function throughout. Fly one pass in each of the following events for refamiliarization (Motion On):	
Low Angle Strafe	
Low Level Bomb	
10° Skip	
15° Low Angle Bomb	+ 10
Perform each of the following tasks at least three times, and use the allotted time fully (Motion On or Off).	
Low Angle Strafe	
Low Level Bomb	+ 20
10° Skip	
15° Low Angle Bomb	+ 30
Perform each of the tasks at least three more times (Motion On or Off)	
Low Angle Strafe	
Low Level Bomb	
10° Skip	
15° Low Angle Bomb	+ 45

ASUPT 4

a. Time: 45 minutes

b. Cockpit: B only

c. Motion: 50% On - 50% Off (Random)

d. Initialization: Conventional Range; WX Cat A; 30° Quartering Headwind

e. Flight Area: Conventional Range

f. Purpose: Analyze high angle events on the conventional range. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of high angle weaponry tasks.

g. Description	Time Guide
Use the reset function throughout. Fly one pass in each of the following events for refamiliarization (Motion On):	
30° Dive Bomb	
30° High Angle Strafe	
45° Dive Bomb	
60° Dive Bomb	+ 10
Perform each of the following tasks at least three times and use the allotted time fully (Motion On or Off):	
30° Dive Bomb	
30° High Angle Strafe	+ 20
45° Dive Bomb	
60° Dive Bomb	+ 30
Perform each of the tasks at least three more times (Motion On or Off):	
30° Dive Bomb	
30° High Angle Strafe	
45° Dive Bomb	
60° Dive Bomb	+ 45

a. Time: 60 minutes

b. Cockpit: B - Evaluator; A - lead/FAC Pilot

c. Motion: On

d. Initialization: Runway; WX Cat A; Calm

e. Flight Area: Town Complex

f. Purpose: Familiarization with the town complex. Analysis of formation flight and mutual support. Pilot should be able to form definite opinions about the devices capability to allow performance of formation and mutual support tasks. Pilot should be able to operate aircraft in a tactical environment.

g. Description	Time Guide
Brief the pilot that there is a north town and south town, an interconnecting road, and an AAA sight located between the towns.	
Perform a formation takeoff and proceed to the town complex. While en route, perform the following formation tasks:	
Close, Route, Crossunder, Close Trail, Tactical	+ 15
When approaching the town complex, Cockpit B will take spacing on lead aircraft, and perform the following events using two ship flight tactics: LAS, 15° LAB, 30° DB	+ 30
Separate the flight. Cockpit A will assume the FAC role and proceed to the North town. Cockpit B will initially hold over the South town. The FAC will identify the targets either verbally or with a ground marking device. Cockpit B will proceed to the target area, follow the FAC's instructions, and perform the following tasks. Restricted Run-in attacks, 10° SKIP, 30° HAS, 30° DB.	+ 45
Joinup, RTB. Using WX Cat C, terminate the mission with a formation full stop landing.	+ 60

ASUPT 6

a. Time: 45 minutes

b. Cockpit: B - Evaluator; A - Lead Pilot

c. Motion: Initially Off, then 50% On - 50% Off (Random)

d. Initialization: Runway; WX Cat A; Wind $345^{o}/10^{o}$ knots

e. Flight Area: Town Complex

f. Purpose: Analyze low angle events on the tactical range. Further analyze formation tasks. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of low angle weaponry tasks in a tactical environment.

g. Description	Time Guide
Perform a formation takeoff and fly to the town complex and perform the following formation tasks en route (motion Off): Close, extended trail, tactical lead A/C will RTB and Cockpit B will proceed to the town complex. Change the visibility to 40,000 ft and turn motion on. Fly one pass in each of the following events against a target of opportunity (Motion - On): LAS, 10^{o} SKIP, 15^{o} LAB	+ 15
Perform each of the following tasks at least three times (Motion on or off) LAS, 10^{o} SKIP, 15^{o} LAB	+ 30
Perform each task at least three more times. Terminate the mission on range (motion on or off)	+ 45

a. Time: 45 minutes

b. Cockpit: B only

c. Motion: Initially on, then 50% On - 50% Off (Random)

d. Initialization: Mountain area, dusk, 50%; Vis - 60,000'; Wind - calm

e. Flight Area: Initially mountain area, then town complex

f. Purpose: To determine if pilots can locate, identify, and attack a concealed target during adverse weather conditions and to analyze high angle events on the tactical range. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of high angle weaponry tasks in a tactical environment.

g. Description	Time Guide
Brief the pilot that there is an island under a bridge between two mountains and that the target is a large munitions factory on the island. The pilot must locate, identify, and attack the factory on one pass thru the valley.	
Unfreeze the aircraft, maintain 360° @ 6500', find and attack the factory using a 15° LAB or 30° DB pass. Depart the mountain area hdg 270°.	
Proceed to the town complex, change the wind to 045°/20 knots, and fly one pass in each of the following tasks against a target of opportunity (Motion - On): 30° DB, 30° HAS, 45° DB	+ 15
Perform each of the following tasks at least three times (motion on or off) 30° DB, 30° HAS, 45° DB	+ 30
Perform each task at least three more times (motion on or off) 30° DB, 30° HAS, 45° DB	+ 45

ASUPT 8

a. Time: 60 minutes

b. Cockpit: B only

c. Motion: 50% on - 50% off

d. Initialization: Mountain area, dusk, 50%; Vis - 60,000; Winds 345^{o}/15 knots

e. Flight Area: Mountain area and town complex

f. Purpose: To determine if the visual system can create a target area that will provide the pilot a high degree of difficulty in locating, identifying, and attacking a desired object. At the conclusion of this sortie, the pilot should be able to determine the capability of the visual scene to create a complex target area and thus increase the task difficulty.

g. Description	Time Guide
Brief the pilot that there is a ship docked on the west side of the island on the north side of the bridge. The pilot has one pass to acquire and attack the ship.	
Unfreeze the aircraft, maintain 355^{o} @ 6500', find and attack the ship, and depart the mountain area (motion on)	+ 10
Return to the mountain area and perform multiple low and high angle weaponry passes on targets of opportunity. Rotate between day, dusk, and night conditions in order to change target positions (motion on or off). Score all deliveries.	+ 30
Strike the island complex several times using a pop-up delivery over the mountain (i.e. terrain masking) (motion on/off)	+ 45
Return to the town complex and perform defensive maneuvers against the moving model. Terminate the mission in the town area. (motion on/off)	+ 60

NOTE: Ask the pilot if the motion is on or off and record responses.

a. Time: 60 minutes

b. Cockpit: B only

c. Motion: Initially on, then 50% on - 50% off (Random)

d. Initialization: Conventional gunnery range, WX Cat A, Night, Wind - 315°/10 knots

e. Flight Area: Conventional Range

f. Purpose: To determine if the visual system can portray a night weaponry range and determine its adequacy for use in performing night gunnery tasks: To analyze daytime gunnery tasks when performed under restricted weather conditions. At the conclusion of this mission the pilot should be able to form definite opinions about the suitability of the night gunnery range and further analyze daytime tasks.

g. Description	Time Guide
Unfreeze, enter a left hand gunnery pattern (night) and perform the following tasks six times (motion on) 15° LAB, 30° DB	+ 20
Change conditions to day, vis - 20,000', ceiling 3000'. Using a right traffic pattern, perform each of the following tasks four times using a curvilinear approach (motion on (1,3,5)/off (2,4,6)) LAS, 15° LAB.	+ 35
Fly each task four more times using a curvilinear approach (motion on (2,4,6)/off (1,3,5)) LAS, 15° LAB	+ 50
Change to a left traffic pattern, enter a false indicated altitude in the altimeter, and perform four 15° LAB passes.	+ 60

ASUPT 10

a. Time: 60 minutes

b. Cockpit: B - Evaluator; A - Lead Pilot (15 minutes)

c. Motion: 50% On - 50% Off

d. Initialization: Williams Data Base, Airborne with lead aircraft, WX Cat A, Wind 060°/10 knots

e. Flight Area: Williams low level, then A-10 data base airfield

f. Purpose: To analyze formation tasks when performed against a detailed aircraft; to analyze low level tasks; to analyze approach and landing tasks (day and night). At the completion of this mission, the pilot should be able to form definite opinions concerning formation, low level, approach, and landing tasks.

g. Description	Time Guide
NOTE: Brief the pilot that the motion will be on and off during the formation portion, and solicit his opinion as to the effect of motion on the task difficulty.	
Unfreeze, and perform the following formation task (motion on/off): Close	
Continue the formation tasks for five minutes (motion on/off): Close	+ 15
Reinitialize at Williams AFB and fly a visual low level route until passing the second checkpoint (motion - on)	+ 35
Reload the A-10 environment and initialize on a GCA final at night, vis - 20,000', ceiling 1900' MSL (500' AGL). Perform a GCA approach and landing. Execute a visual touch and go landing (increase the ceiling to 2500'), and perform multiple closed patterns and night overhead patterns (motion - on)	+ 50
Change to day conditions and use the remainder of this mission to perform day VFR overhead patterns	+ 60

ASUPT - MISSION #11 (REFLY)

a. Time: 60 Minutes
b. Motion: ON
c. Initialization: Runway; 10 knot wind; Limited Visability; "G"-seat: ON; tank started: Slaved Visual.
d. Flight Area: Runway, town, and a conventional range area.
e. Purpose: To gather data on a variety of tasks as a method of determining the relative rating of the ASUPT system during the previous ten sortie evaluation; To observe the following system features:

1. Monochrome CIG Display
2. Wide Angle FOV
3. Full vs Limited AOI
4. 7 vs 3 Window CRT Display
5. Smooth Object Edges
6. Weather Conditions
7. 2000 Edge Modeling Detail
8. Imagery Alignment Between Windows
9. ASUPT vs SAAC Motion

f. Description — Time Guide

Motion: ON (All Pilots)
Start on the runway. Takeoff, depart the airfield complex, return to the final approach and perform a straight-in touch and go landing. Depart the airfield, reinitialize in the town area, and locate the moving tank. Attack the tank using a random attack and 30° DB pass. Reattack the tank using a 30 HAS pass. Depart the town. +15

Initialize on the range. (Do not use the initialization feature between releases.) Establish a left hand box pattern and perform the following tasks (one pass in each event for warm up):

15° LAB @ 800'	Standard Pattern	2 Releases
15° LAB @ 800'	Curvilinear Pattern	2 Releases
LAS @ 2000' Foul	Standard Pattern	2 Releases
LAS @ 2000' Foul	Curvilinear Pattern	2 Releases
30° DB @ 3000'	Standard Pattern	2 Releases
30° DB @ 3000'	Pop-Up Pattern	2 Releases

+45

Return to the runway area (fly - do not initialize) and enter initial. Pitchout and perform a touch and go landing. Perform multiple random attacks against targets of opportunity on the airfield (aircraft for score). Terminate with a full stop landing.

+60

BRIEFING GUIDE - LAMARS

Use this guide to brief and control each mission.

1. During the mission, evaluate the tasks and references as listed on the appropriate analysis form for the respective mission. Record as many of the pilot's comments on the Mission Remarks Log as time will allow. Insure that the tape recorder is operating. Maintain the Weapons Log, if applicable.

2. At the completion of the mission, the pilot, briefer, and technical representative will debrief the mission. Use the notes and recording obtained during the mission, as appropriate. Discuss the inflight comments and derived opinions sufficiently so that the technical representative fully understands any issues that may subsequently arise. The technical representative has been instructed to have limited participation in this briefing so that the pilots will continue to offer original opinions concerning the visual scene.

3. After the debriefing, the pilot will complete the debriefing questionnaire for the mission just flown.

4. Give all paperwork to the Phase II manager.

LAMARS 1

a. Time: 60 minutes

b. Motion: Off - 20 min, then On - 40 min

c. Initialization: 5000:1 Board; Runway Area; Clear Visibility; Winds - calm; CGI HUD On. Leave safety rail in place. Sky globe 65 watts, earth globe 15 watts, all missions.

d. Flight Area: Northern portion of 5000:1 board

e. Purpose: Familiarization with simulator flight characteristics and visual presentation. Pilot should be able to fly the simulated aircraft in the visual environment at the completion of this mission.

f. Description	Time Guide
Motion Off Run: (Start the following mission)	+ 05
Climb to 5,000 ft+. Interpret the CGI HUD, remain in the northeast quadrant of the environment and perform the following tasks: Lazy Eight, Chandelle, Slow Flight, Stalls, Aileron Roll, Barrel Roll. Allow the pilot to descend to 2000 feet, and actuate the probe freeze button.	+ 30
Return to the runway complex and perform a straight in approach to a 300 foot low approach. Execute a go-around and depart the runway area. Reenter the traffic pattern and perform multiple VFR overhead and closed patterns.	+ 60

NOTE: Brief the 1000 ft/250 ft altitude restriction area on the 5000:1 board.

Flight Specifics

Slow flight and stalls: 150 KIAS - 16 units
Chandelle and lazy eight: 90%; 150 - 350 KIAS
Aileron and barrel roll: 85-90%; 250 - 350 KIAS
Approach and landing

250 Initial	90 Back Stick
200 G & F	100 Light Off
125 Base	130 Gear and Flaps
115 Final	150 Closed
95 Touch Down	250 Reentry

LAMARS 2

a. Time: 60 minutes

b. Motion: On

c. Initialization: 5000:1 Board; Runway Area; Clear Visibility; Winds - calm; leave safety rail in place.

d. Flight Area: Northeast quadrant of 5000:1 board

e. Purpose: Orientation with this device's simulated weaponry deliveries. At the completion of this mission, the pilot should have a validated set of mill settings to use throughout the evaluation and be able to use the conventional target for air to ground deliveries.

f. Description	Time Guide
Motion Off Run: 30° DB pass and recovery	+ 05
Using initialization control, obtain individual mil settings for 10° SKIP, 15° LAB, 20° LALD, 30° DB, 45° DB, 45° HADB, LAS, and HAS. Establish a box pattern using a south to north run-in heading on the conventional ground target.	+ 20
Perform each of the above events at least three times.	+ 60

NOTE: Select target centered AOI for a portion of this flight for demonstration purposes.

LAMARS 3

a. Time: 60 minutes

b. Motion: Initially On; then 50% Off - 50% On (1,3,5 - On/Off; 2,4, 6 - Off/On)

c. Initialization: 5000:1 Board; Runway Area; Clear Visibility; Winds - 315^{o}/20 knots; safety rail down for remainder of mission

d. Flight Area: Northeast quadrant of 5000:1 board

e. Purpose: Analyze high angle events performed against a conventional target. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of high angle weaponry tasks against a conventional target.

f. Description	Time Guide
Motion Off Run: 30^{o} DB pass and recovery	+ 05
With motion on or off, fly one pass in each of the following events: 30^{o} DB, 45^{o} DB, 45^{o} HADB, 30^{o} HAS	+ 15
Then, fly at least three passes in each event. Fly additional passes in any event on a time available basis.	+ 40
Then, select the remaining motion setting and fly at least three additional passes in each event.	+ 60

LAMARS 4

a. Time: 60 minutes

b. Motion: Initially On, then 50% Off - 50% On

c. Initialization: 5000:1 Board; Runway Area; Clear Visibility; Winds - 090°/10 knots

d. Flight Area: Northeast quadrant of 5000:1 board

e. Purpose: Analyze low angle events performed against a conventional target. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of low angle weaponry tasks against a conventional target.

f. Description	Time Guide
Motion Off Run: 15° LAB pass and recovery	+ 05
With motion on or off, fly one pass in each of the following events: LAS, 10° SKIP, 15° LAB, 20° LALD.	+ 15
Then fly at least three passes in each event. Fly additional passes, time permitting.	+ 40
Select the remaining motion setting and fly at least three additional passes in each event.	+ 60

LAMARS 5

a. Time: 60 minutes

b. Motion: On

c. Initialization: 5000:1 Board; Runway Area: Clear Visibility; Winds - 360°/10 knots

d. Flight Area: Eastern half of 5000:1 Board

e. Purpose: Familiarization with tactical targets. At the completion of this mission, the pilot should be able to operate in a tactical area.

f. Description	Time Guide
Motion Off Run: 30° DB delivery and recovery on conventional target	+ 05
Turn motion on and brief the pilot that there is a south to north river on the eastern side of the environment, and that there are the following three targets that must be located and attacked: Suspension Bridge; Gravel Pit Building; Dam Pump House. Locate the Suspension Bridge, establish a box pattern, and attack the bridge using at least two passes in each of the following events: 30° DB, 45° DB, 45° HADB.	+ 20
Locate the Gravel Pit Building. Using random attacks, attack the building while performing at least two passes in each of the following events: LAS, 10° SKIP, 15° LAB.	+ 40
Locate the Dam Pump House and strike it using at least two passes in each of the following events: 20° LALD, 30° DB, 30° HAS.	+ 60

NOTE: After the initial pass against each target, select target - slaved AOI and allow the pilot to perform several passes using this technique.

LAMARS 6

a. Time: 60 minutes

b. Motion: Initially On, then 50% Off - 50% On

c. Initialization: 5000:1 Board; Runway Area; Reduced Visibility (3-4 mi); Winds - 045°/15 knots

d. Purpose: To determine if the visual system can make it difficult for the pilot to locate, identify, and attack a target during adverse weather conditions and to analyze high angle events in a tactical environment. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of high angle weaponry tasks in a tactical environment.

e. Description	Time Guide
Motion Off Run: 30° DB pass and recovery	+ 05
Turn motion on or off. Brief the pilot that there is an East/West canal on the Northern portion of the environment (start heading West just North of the Suspension Bridge/Gravel Pit Area). The pilot is to perform armed reconnaissance west along that river and attack the railroad overpass after passing a small town that is on the Northern bank of the river. Attack the overpass with one 30° DB pass.	+ 15
Increase the vis to 7 mi. Reattack the overpass using a restricted attack heading of approximately 090° (paralleling the river) and the following events (at least two passes each): 45° DB, 45° HADB.	+ 25
Fly further West until locating an abandoned airfield which is South of the river and West of a large town. Attack a building on the Southern side of the airfield using two passes in each of the following events. Use a pop-up (from 1200 feet) approach from the western side of the airfield: 30° DB, 30° HAS.	+ 45
Select the other motion setting, and fly around the town for approximately five minutes and record your observations. Follow a road to the East and slightly North of the mountainous area. Locate and attack a road intersection, as briefed in flight. (Remain above 1000 feet AGL at all times when in the mountainous area). Employ multiple 30° DB and 30° HAS against the road intersection, using pop-up approaches.	+ 60

LAMARS 7

a. Time: 60 minutes

b. Motion: On

c. Initialization: 1500:1 board; appx 7 mi final; Clear Visibility; Simulated Ceiling at Maximum Altitude (3000 ft); Winds - calm

d. Flight Area: 1500:1 Board

e. Purpose: To introduce the pilot to the takeoff and landing capabilities of this visual system and to analyze low angle events in a tactical environment. At the completion of this mission, the pilot should be able to perform takeoff and landing tasks and should be able to form definite opinions about the suitability of the visual scene to allow performance of low angle weaponry tasks in a tactical environment.

f. Description	Time Guide
Motion Off Run: 50 ft low approach	+ 05
Turn motion on and perform a straight-in 50 foot low approach. Reenter, and perform another 50' low approach. Depart the runway complex heading west.	+ 15
Locate the Suspension Bridge and the Gravel Pit. Locate the Bulldozer on a hill in the Gravel Pit. Perform one pass in each of the following events against the Bulldozer: 20° LALD (modified due to maximum altitude restriction), 15° LAB, 10° SKIP, LAS.	+ 25
Locate the Strafe target, and perform three passes in each of the following events: Using a curvilinear approach: LAS, 10° SKIP.	+ 35
Locate the two large aircraft near a hanger on the Southwest side of the airfield. Attack the one furthest to the West using three passes in each of the following events, using a curvilinear approach: 15° LAB, 20° LALD.	+ 50
Reenter initial, and perform at least two VFR Overhead approaches, closed patterns, and touch and go landings.	+ 60

NOTE: Brief the 150 ft/14 ft altitude restriction areas on the 1500:1 board.

NOTE: Use caution for several 300' trees on final approach (2-3 mi).

LAMARS 8

a. Time: 60 minutes

b. Motion: 50% Off - 50% On

c. Initialization: 1500:1 board; approx 7 mi final; clear visibility; simulated ceiling at maximum altitude (3000 ft); winds - 045°/10 knots

d. Flight Area: 1500:1 board, runway complex

e. Purpose: To analyze takeoff and landing tasks. At the completion of this mission, the pilot should be able to form definite opinions concerning traffic pattern tasks.

f. Description	Time Guide
Motion off run: Straight in low approach, missed approach, and closed pattern	+ 05
With motion on/off and with head slaved AOI, initial, pitch out, and perform at least three sets of the following tasks: VFR overhead, touch and go landing, closed pattern.	+ 15
Select geographically centered AOI*, and perform three additional touch and go landings. Reenter as desired.	+ 25
Select the other motion setting, leave the AOI geographically centered*, reeenter initial, and perform three more touch and go landings.	+ 40
Revert to head slaved AOI and perform three more touch and go landings.	+ 50
Leave the motion as set. Select night conditions (pitch black = light bank off) and either slaving technique (pilot's choice), and perform two night VFR overhead patterns and 50 foot low approaches (night landings will be performed on LAMARS 9).	+ 60

*NOTE: Reselect head slaved AOI between touchdown and downwind, when using fixed AOI control.

NOTE: Runway lights are unidirectional.

LAMARS 9

a. Time: 60 minutes

b. Motion: 50% Off - 50% On (Selected)

c. Initialization: 1500:1 board; appx 7 mi final; reduced visibility (7 mi); simulated ceiling at maximum altitude (3000 ft); winds - 135°/10 knots

d. Flight Area: 1500:1 board

e. Purpose: To analyze low angle events using pop up patterns and curvilinear approaches in a tactical environment. At the completion of this mission the pilot should be able to form definite opinions about the visual systems suitability to allow performance of tactical approaches to targets using a combination of pop up, curvilinear, and low angle tasks.

f. Description	Time Guide
Motion off run: (Start the following mission)	+ 00
With motion off, perform a touch and go landing and depart the runway complex heading east. Locate a tank farm to the west of the runway and strike the short center tank using a restricted heading, pop up pattern, curvilinear approach, and 15° LAB pass, as briefed. Perform at least two additional 15° LAB patterns and two 10° SKIP passes against the tank.	+ 15
Locate a complex of five buildings northwest of the runway. Attack the building furthest to the east on an east to west heading. Perform at least two 20° LALD deliveries and two LAS deliveries.	+ 25
Turn the motion on, select night conditions, clear visibility, and return to the end of the runway complex and perform the following night weaponry tasks against the scored end of the runway (target is southern strobe on south R/W). Perform at least three passes per event, using a mandatory minimum altitude of 200 feet: 20° LALD, 15° LAB, 15° LAS.	+ 50
Perform a night straight in approach to a touch and go landing. Execute a go around after touchdown, enter a closed pattern, and execute multiple overhead patterns and touch and go landings.	+ 60

NOTE: Runway lights are uni-directional.

LAMARS 10

a. Time: 60 minutes

b. Motion: On

c. Initialization: 5000:1 board; runway; reduced visibility (5 mi); simulated ceiling at 7000 feet MSL; winds - calm

d. Flight Area: 5000:1 board

e. Purpose: To analyze low-level navigation, terrain masking, and moving model operations. At the completion of this mission, the pilot should be able to judge the capability of this visual system to allow performance of low-level, terrain masking, and moving model tasks.

f. Description	Time Guide
Motion off run: 30° DB pass, conventional target	+ 05
Turn motion on and fly the low level route at 1200-1500 feet AGL, 300 KIAS. Attack the target, using a 30° DB pass.	+ 30
Attack the target two additional times, using terrain masking, pop up patterns, and 30° DB passes (1200-1500 foot min altitude for terrain masking and pop-up). Locate the moving model and attack it using 15° LAB and LAS passes.	+ 45
Perform 15° LAB passes against the conventional target as follows: 4 passes - correct altimeter 4 paases - erroneous altimeter Reverse order for pilots 2, 4, and 6.	+ 60

BRIEFING GUIDE - SAAC/#18

Use this guide to brief and control each mission.

1. During the mission, evaluate the tasks and references as listed on the appropriate analysis form for the respective mission. Record as many of the pilot's comments on the Mission Remarks Log as time will allow. Insure that the tape recorder is operating. Maintain the Weapons Log, if applicable.

2. At the completion of the mission, the pilot, briefer, and technical representative will debrief the mission. Use the notes and recording obtained during the mission, as appropriate. Discuss the inflight comments and derived opinions sufficiently so that the technical representative fully understands any issues that may subsequently arise. The technical representative has been instructed to have limited participation in this briefing so that the pilots will continue to offer original opinions concerning the visual scene.

3. After the debriefing, the pilot will complete the debriefing questionnaire for the mission just flown.

4. Give all paperwork to the Phase II manager.

5. Initialization points

NUMBER	A/C LOCATION	AOI CENTER	A/C SPECIFICS
00	Approach to R/ W13	MID R/W	300' - 250 KIAS - 135 Degrees
01	◇ LAB + LALD BASE	CIRCLE	3000'-350 KIAS - 015 Degrees
02	◇ DB + HAS BASE	CIRCLE	10,5000'-350 KIAS-015 Degrees
03	○ LAB + LALD BASE	CIRCLE	3000'-350 KIAS-045 Degrees
04	○ DB + HAS BASE	CIRCLE	10,5000'-350 KIAS-045 Degrees
05	5 miles southwest of airfield	AIRFIELD BLDG.	10,000'-450 KIAS-315 Degrees
06	5 miles southwest of airfield	T BLDG.	4,000'-450 KIAS-315 Degrees
07	◇ LAS BASE	STRAFETGT #4	3000'-350 KIAS-015 Degrees
08	○ LAS BASE	STRAFETGT #4	3000'-350 KIAS-045 Degrees
09	6 MILE FINAL R/W17 (1500:1)	MID R/W	2500'-250 KIAS-170 Degrees
07 - 17	◇ SKIP BASE	RIGHT BOX	3000'-350 KIAS-015 Degrees
08 - 28	○ SKIP BASE	RIGHT BOX	3000'-350 KIAS-045 Degrees

a. Time: 60 minutes

b. Motion: On

c. Initialization: 4000:1 Runway area: Airborne approach end runway 13 (initialize 00); AOI centered toward departure end of runway.

d. Flight Area: Runway area

e. Purpose: Familiarization with simulator flight characteristics and visual presentation. Pilot should be able to fly the simulated aircraft in the visual environment at the completion of this mission.

f. Description		Time Guide
Remain in the runway area and perform the following tasks:		
Slow Flight/Approach to Stalls AOA (FAM)		
Lazy Eight	Loop	
Chandelle	Immelmann	
Aileron Roll	Split-S	
Barrel Roll	Cuban Eight	
Cloverleaf	Out of Control/Spin	+ 30
Descend to 1000 feet and exercise the probe protection system. (System Freeze).		+ 35
Return to the runway area and perform a straight-in low approach to 200 feet. Execute a go-around, reenter, and perform multiple VFR overhead and closed patterns.		+60

a. Time: 60 minutes

b. Motion: On

c. Initialization: 4000:1 Range area; Diamond range, Base leg for dive bomb on right circle (initialize 02); AOI centered on right dive bomb circle.

d. Flight Area: Diamond and conventional gunnery ranges.

e. Purpose: Orientation with this device's simulated weaponry deliveries. At the completion of this mission, the pilot should have a validated set of mill settings to use throughout the evaluation and be able to use the gunnery ranges for air-to-ground deliveries.

f. Description	Time Guide
Establish a left-hand box pattern on the right side of diamond range and perform each of the following events three times: Use reset on high angle.	
30 Degrees DB — 20 Degrees LALD (initialize 01)	
30 Degrees HAS — 15 Degrees LAB	
45 Degrees DB — 10 Degrees SKIP (initialize 07-17)	
45 Degrees HADB — 15 Degrees LAS (High threat minimum 300') (initialize 07)	+ 45
Proceed to the conventional range and perform each of the following events at least once	
20 Degrees LALD (initialize 03) — 10 Degrees SKIP (initialize 08-28)	
15 Degrees LAB — 15 Degrees LAS (initialize 08)	+60

a. Time: 60 minutes

b. Motion: Pilots 1, 3, 5 - On; Pilots 2, 4, 6 - Off

c. Initialization: 4000:1 Range Area; Diamond Range, BASE leg for LALD on right circle (01); AOI centered on right dive bomb circle.

d. Flight Area: Diamond and conventional gunnery ranges

e. Purpose: Analyze low-angle events as performed on a conventional range. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of low-angle weaponry tasks on a conventional range.

f. Description	Time Guide
With the motion on or off, establish a left-hand box pattern on the right side of the diamond range, and perform each of the following events three times:	
20 Degrees LALD (01) 15 Degrees LAB 10 Degrees SKIP (07-17) 15 Degrees LAS (High threat) (07)	+ [illegible]
Proceed to the conventional range, and perform each of the following events three times:	
20 Degrees LALD (03) 15 Degrees LAB 10 Degrees SKIP (08-28) 15 Degrees LAS (08)	+ 5[illegible]
Return to the runway (00) and perform multiple overhead patterns and low approaches.	+ 60

a. Time: 60 minutes

b. Motion: Pilots 1, 3, 5 - On; Pilots 2, 4, 6 - Off

c. Initialization: 4000:1 Range Area; Diamond range, base leg for DB on right circle (02); AOI centered on right dive bomb circle

d. Flight Area: Diamond and conventional gunnery ranges

e. Purpose: Analyze high-angle events as performed on a conventional range. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of high-angle weaponry tasks on a conventional range.

f. Description	Time Guide
With motion on or off, establish a left-hand box pattern on the right side of the diamond range, and perform each of the following events three times:	
30 Degrees DB(02) 30 Degrees HAS 45 Degrees DB 45 Degrees HADB	+25
Proceed to the conventional range, and perform each of the following events three times:	
30 Degrees DB (04) 30 Degrees HAS 45 Degrees DB 45 Degrees HADB	+ 50
Use the remainder of the hour to perform several passes in each of the following events for familiarization on the conventional range:	
15 Degrees LAS (08) 15 Degrees LAB (03)	+ 60

a. Time: 60 minutes

b. Motion: Pilots 1, 3, 5 - Off; Pilots 2, 4, 6 - On

c. Initialization: 4000:1 Range Area; Diamond range, base leg for LALD on right circle (01); AOI centered on right dive bomb circle.

d. Flight Area: Diamond and conventional gunnery ranges

e. Purpose: Analyze low-angle events as performed on a conventional range. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of low-angle weaponry tasks on a conventional range.

f. Description	Time Guide
With motion off or on, establish a left-hand box pattern on the right side of the diamond range, and perform each of the following events three times:	
20 Degrees LALD (01) 15 Degrees LAB 10 Degrees SKIP (07-17) 15 Degrees LAS(night threat) (07)	+
Proceed to the conventional range, and perform each of the following events three times:	
20 Degrees LALD (03) 15 Degrees LAB 10 Degrees SKIP (08-28) 15 Degrees LAS (08)	+ 5(
Return to the runway (00) and perform multiple overhead patterns and low approaches.	+ 6(

a. Time: 60 minutes

b. Motion: Pilots 1, 3, 5 - Off; Pilots 2, 4, 6 - On

c. Initialization: 4000:1 Range Area; Diamond range, base leg for DB on right circle (02); AOI centered on right bomb circle.

d. Flight Area: Diamond and conventional gunnery ranges

e. Purpose: Analyze high-angle events as performed on a conventional range. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of high-angle weaponry tasks on a conventional range.

f. Description	Time Guide
With motion off or on, establish a left-hand box pattern on the right side of the diamond range, and perform each of the following events three times:	
30 Degrees DB (02) 30 Degrees HAS 45 Degrees DB 45 Degrees HADB	+ 25
Proceed to the conventional range, and perform each of the following events three times:	
30 Degrees DB (04) 30 Degrees HAS 45 Degrees DB 45 Degrees HADB	+ 50
Use the remainder of the hour to perform several passes in each of the following events on the conventional range:	
15 Degrees LAS (08) 15 Degrees LAB (03)	+ 60

a. Time: 60 minutes

b. Motion: 50% - On; 50% - Off (1, 3, 5 - On/Off; 2, 4, 6 - Off/On)

c. Initialization: 4000:1 Tactical Area; 5NM southwest of runway-initialize (05); AOI centered on large white building on airfield.

d. Flight Area: Tactical target areas

e. Purpose: Familiarization with and analysis of tactical range low-angle weaponry tasks. At the completion of this mission, the pilot should be able to form definite opinions concerning the suitability of the visual scene to allow performance of low-angle weaponry tasks on tactical targets.

f. Description	Time Guide
With motion on or off, maintain 315 degrees, obtain the video, perform armed reconnaissance and locate the tactical target (hanger on south side of airfield ramp) as briefed. Drop one 20 degrees LALD bomb, locate a hanger (initialize 00) south of the runway near the approached end to 31, and perform six passes in each of the following events using a restricted run-in attack (parallel to runway) pattern:	
15 Degrees LAS .. 10 Degrees SKIP	+ 25
Select the other motion setting, locate the other tactical targets, (targets of opportunity between AOI center and conventional weaponry range) as briefed, and perform six passes in each of the following events, using a curvilinear approach when appropriate:	
15 Degrees LAB 20 Degrees LALD	+ 50
Perform at least three more 20 Degree LALD passes, using a pop-up pattern, against the large white building in the range area (05).	+ 60

NOTE: THE BUILDINGS IN THE TARGET AREA ARE TALL ENOUGH TO BE HIT BY THE PROBE. DO NOT PRESS OR ATTACK TALL BUILDINGS.

a. Time: 60 minutes

b. Motion: 50% - On; 50% - Off (1, 3, 5 - On/Off; 2,4, 6 - Off/On)

c. Initialization: 4000:1 Range Area: 5 NM southwest of runway (06); G-Seat off; AOI centered on small white T-shape building west of airfield.

d. Flight Area: Tactical target areas and 1500:1 board airfield.

e. Purpose: Analysis of tactical range high-angle weaponry tasks and traffic pattern tasks. At the completion of this mission, the pilot should be able to form definite opinions concerning the suitability of the visual scene to allow performance of high-angle weaponry tasks on tactical targets and traffic pattern tasks.

f. Description	Time Guide
With motion on or off, locate the tactical target, as briefed, and perform three passes in each event using random attack patterns:	
30 Degrees DB 30 Degrees HAS 45 Degrees DB 45 Degrees HADB	+ 15
Locate tactical targets of opportunity, as briefed, and perform three passes in each of the following events:	
30 Degrees DB 30 Degrees HAS 45 Degrees DB 45 Degrees HADB	+ 30
Select the other motion setting, initialize 09, 6 mile final to Runway 17 on the 1500:1 portion of the model board. Perform a straight-in low approach, go around, and depart the runway area using right hand traffic. Reenter initial and perform three overhead VFR approaches and closed patterns. Locate the taxi interrection, 2/3's of the distance down the runway and perform three passes in each of the following events using a mix of curvilinear approaches and pop-up patterns:	
20 Degrees LALD 15 Degrees LAB 15 Degrees LAS 10 Degrees SKIP	+ 60

a. Time: 60 minutes

b. Motion: On

c. Initialization: 1500:1 Runway Area; 6 mile final, runway 17,2500 feet (09); NIGHT.

d. Flight Area: 1500:1 Runway area and target area

e. Purpose: To analyze night pattern, approach, and weaponry tasks. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of traffic patterns, low approaches, and weaponry tasks during night operational conditions.

f. Description	Time Guide
Perform a straight-in low approach, go around, and depart the runway area (right hand traffic). Reenter initial and perform multiple overhead VFR approaches and closed patterns.	+ 20
Locate the target, as briefed, and perform three passes in each of the following events using a curvilinear approach: 20 Degrees LALD 15 Degrees LAB 15 Degrees LAS 10 Degrees SKIP	+ 60

a. Time: 60 minutes

b. Motion: On

c. Initialization: 4000:1 Runway Area; 5 miles southwest of the airfield (05); AOI centered on large white building on airfield range; Tactical formation.

d. Flight Area: Runway Area

e. Purpose: Analyze formation and mutual support tasks as performed in the tactical area. At the completion of this mission, the pilot should be able to form definite opinions about the suitability of the visual scene to allow performance of formation and mutual support tasks.

f. Description	Time Guide
Maintain 315 degrees heading and tactical formation until the tactical target is in sight (if AOI video available).	
Perform the following formation tasks:	
Extended Trail, Fighting Wing, Tactical Formation, Close Trail	+ 15
Attack target of opportunities (within the AOI or STG) using two ship tactics and random attacks.	+ 30
Use the remainder of this mission for Air-to-Air	+ 60

NAVY 2B35 EVALUATION SORTIE

a. Time: 60 Minutes (Order - P-4, P-5, P-6, P-1, P-2, P-3, B-1, B-2, B-3, B-4 all observe throughout.)
b. Motion: 50 Minutes - OFF; 10 Minutes - ON.
c. Initialization: Runway; 10 Knot Wind; Fog; Moving Cloud; Haze; Meat-Ball: OFF; "G"-system: ON .
d. Flight Area: Runway and weaponry range areas.
e. Purpose: Brief familarization with the simulator's flight characteristics and visual presentation. Primary purpose is to obtain opinions about the following simulator features.

1. Color vs Monochrome CIG Diplay
2. 210° x 60° vs Wider Angle FOV
3. Flat vs Curved Diplay
4. Rear vs Front Projector
5. Screen vs CRT Display
6. Screen vs CRT Imagery Alignment
7. Smooth Object Edges
8. Blended vs Sharp Horizon Line
9. Fog, Haze, Moving Cloud, Overcast Conditions
10. 1000 Edge vs 2000 Edge Modeling Detail
11. 3 DOF vs 6 DOF Motion
12. Reduction of FOV with Motion ON

f. Description	Time Guide
Motion: OFF (All Pilots) Start on the runway. Takeoff, depart the airfield complex, return to the final approach and perform a straight-in touch and go landing. Depart the airfield complex and proceed to the weaponry range. Perform an aileron roll and a loop while en route to the range.	+15
Establish a left hand box pattern and perform the following tasks:	

15° LAB@ 800'	Standard Pattern	2 Releases
15° LAB@ 800'	Curvilinear Pattern	2 Releases
LAS@ 2000' Foul	Standard Pattern	2 Releases
LAS@ 2000' Foul	Curvilinear Pattern	2 Releases
30° DB@ 3000'	Standard Pattern	2 Releases
30° DB@ 3000'	Pop-Up Pattern	2 Releases
45° DB@ 4500'	Standard Pattern	3 Attempts

	+45
Return to the runway area and enter initial. Pitchout and perform a touch and go landing.	+50
Motion: ON Perform multiple random attacks against targets of opportunites. Terminate with a full stop landing.	+60

PROJECT 2235

SPECIFIC REFERENCE ANALYSIS

ASUPT - LAMARS - SAAC#18 - DAY - NIGHT

WEATHER CONDITIONS		A CLNG- VIS-							B CLNG- VIS-							C CLNG- VIS-							D CLNG- VIS-						
SPECIFIC REFERENCE CHARACTER.	FOV	SIZE	SHAPE	DETAIL	CLARITY	MOVEMEN	POSITIO	ENVIRON	SIZE	SHAPE	DETAIL	CLARITY	MOVEMEN	POSITIO	ENVIRON	SIZE	SHAPE	DETAIL	CLARITY	MOVEMEN	POSITIO	ENVIRON	SIZE	SHAPE	DETAIL	CLARITY	MOVEMEN	POSITIO	ENVIRON
SPECIFIC REFERENCE																													

Pilot Briefer Mission

PROJECT 2235

SPATIAL ORIENTATION CUE ANALYSIS

ASUPT - LAMARS - SAAC#18 - DAY - NIGHT

WEATHER CONDITION		A CLNG- VIS-							B CLNG- VIS-							C CLNG- VIS-							D CLNG- VIS-						
SPATIAL ORIENTATION CUE	POV	ATTITUDE	DIRECTION	SPEED	ALTITUDE	DISTANCE	LOCATION	LINEUP	ATTITUDE	DIRECTION	SPEED	ALTITUDE	DISTANCE	LOCATION	LINEUP	ATTITUDE	DIRECTION	SPEED	ALTITUDE	DISTANCE	LOCATION	LINEUP	ATTITUDE	DIRECTION	SPEED	ALTITUDE	DISTANCE	LOCATION	LINEUP
TASK																													

Pilot Briefer Mission

MISSION DEBRIEFING QUESTIONNAIRE - ASUPT 1

a. MISSION DURATION:

b. UNACCOMPLISHED TASKS:

c. TASKS WHICH YOU WOULD LIKE TO REFLY:

d. NEW TASKS WHICH YOU WOULD LIKE THE OPPORTUNITY TO FLY:

e. TO WHAT EXTENT DO YOU BELIEVE THAT YOU HAVE A BASIC FEEL FOR THIS SIMULATED AIRCRAFT'S FLIGHT DYNAMICS AND CHARACTERISTICS?

INADEQUATE 1	2 MARGINAL	GOOD 3	VERY GOOD 4	5 OUTSTANDING

f. DO YOU NEED MORE FAMILIARIZATION TIME BEFORE CONTINUING WITH GUNNERY RANGE TASKS?

g. TO WHAT EXTENT DID YOU USE THE SIMULATED VISUAL SCENE THE SAME AS YOU USE AN ACTUAL VISUAL SCENE TO PERFORM AIRWORK AND AEROBATIC MANEUVERS?

SIMULATED VISUAL LESS USABLE			SAME	SIMULATED VISUAL MORE USABLE		
1	2	3	4	5	6	7

MDQ - ASUPT 1 (Cont.)

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK. PLEASE PROVIDE COMMENTS, GOOD OR BAD, ON ALL TASKS.

TASK TITLE	VISUAL SYSTEM CAPABILITY: 1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	COULD YOU PERFORM TASK: YES	NO	MAYBE
SLOW FLIGHT COMMENT	1	2	3	4	5	YES	NO	MAYBE
STALLS COMMENT	1	2	3	4	5	YES	NO	MAYBE
SPINS COMMENT	1	2	3	4	5	YES	NO	MAYBE
VERTICAL RECOVERY COMMENT	1	2	3	4	5	YES	NO	MAYBE
CHANDELLE COMMENT	1	2	3	4	5	YES	NO	MAYBE
LAZY EIGHT COMMENT	1	2	3	4	5	YES	NO	MAYBE
AILERON ROLL COMMENT	1	2	3	4	5	YES	NO	MAYBE
BARREL ROLL COMMENT	1	2	3	4	5	YES	NO	MAYBE
CLOVERLEAF COMMENT	1	2	3	4	5	YES	NO	MAYBE
LOOP COMMENT	1	2	3	4	5	YES	NO	MAYBE
IMMELMANN COMMENT	1	2	3	4	5	YES	NO	MAYBE
SPLIT-S COMMENT	1	2	3	4	5	YES	NO	MAYBE
CUBAN EIGHT COMMENT	1	2	3	4	5	YES	NO	MAYBE

PILOT #:
TIME OF DAY:
DATE:

MISSION DEBRIEFING QUESTIONNAIRE - ASUPT 2

a. MISSION DURATION:

b. UNACCOMPLISHED TASKS:

c. TASKS WHICH YOU WOULD LIKE TO REFLY:

d. NEW TASKS WHICH YOU WOULD LIKE THE OPPORTUNITY TO FLY:

e. TO WHAT EXTENT DO YOU BELIEVE YOUR T-37 FAMILIARIZATION SIMULATOR SORTIE AND YOUR FIRST SORTIE IN THIS DEVICE PREPARED YOU FOR THE FIRST WEAPONRY SORTIE:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

f. TO WHAT EXTENT DO YOU BELIEVE THAT YOU HAVE A GOOD FEEL FOR THIS SIMULATED AIRCRAFT'S FLIGHT DYNAMICS AND CHARACTERISTICS ON THE CONVENTIONAL GUNNERY RANGE:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

g. TO WHAT EXTENT CAN YOU USE THE SIMULATOR'S VISUAL SCENE THE SAME AS YOU WOULD USE AN ACTUAL RANGE SCENE TO PERFORM GUNNERY TASKS?

SIMULATED VISUAL LESS USABLE			SAME	SIMULATED VISUAL MORE USABLE		
1	2	3	4	5	6	7

h. TO WHAT EXTENT DID YOU FIND THE REINITIALIZATION FEATURE OF THE SIMULATOR HARMFUL OR HELPFUL IN COMPLETING MULTIPLE WEAPONRY PASSES?

VERY HARMFUL	SOMEWHAT HARMFUL	NEITHER HELPFUL NOR HARMFUL	SOMEWHAT HELPFUL	VERY HELPFUL
1	2	3	4	5

i. DO YOU FEEL THAT REINITIALIZING IN THE WEAPONRY PATTERN MIGHT BE LETTING YOU DEVELOP BAD HABITS CONCERNING AIRSPEED, ALTITUDE, AND GROUND TRACK CONTROL ON CROSSWIND AND DOWNWIND.

Comment: ____________________

____

____

____

____

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK.

SPECIAL NOTE: PROVIDE COMMENTS, GOOD OR BAD, ON ALL TASKS:

TASK TITLE	VISUAL SYSTEM CAPABILITY					COULD YOU PERFORM TASK		
	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	YES	NO	MAYBE
TAKEOFF	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
DEPARTURE	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
BOX PATTERN	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
ROLL-IN	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
RECOVERY	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								

PILOT #:
MISSION #:
TIME OF DAY:
DATE:

MISSION DEBRIEFING QUESTIONNAIRE - ASUPT 3/4

a. MISSION DURATION:

b. UNACCOMPLISHED TASKS:

c. TASKS WHICH YOU WOULD LIKE TO FLY:

d. NEW TASKS WHICH YOU WOULD LIKE THE OPPORTUNITY TO FLY:

e. TO WHAT EXTENT DID YOU FIND THE REINITIALIZATION FEATURE OF THE SIMULATOR HARMFUL OR HELPFUL IN COMPLETING MULTIPLE WEAPONRY PASSES?

VERY HARMFUL	SOMEWHAT HARMFUL	NEITHER HARFUL NOR HELPFUL	SOMEWHAT HELPFUL	VERY HELPFUL
1	2	3	4	5

COMMENT: ____

____

____

f. IN AN ACTUAL AIRCRAFT, RATE THE EXTENT TO WHICH YOU USE OUTSIDE-THE-COCKPIT CUES AS OPPOSED TO INSIDE-THE-COCKPIT CUES TO DETERMINE TIME TO RELEASE ORDNANCE.

OUTSIDE CUES HEAVILY PREDOMINANT	OUTSIDE CUES SLIGHTLY PREDOMINANT	EVENLY USE INSIDE AND OUTSIDE CUES	INSIDE CUES SLIGHTLY PREDOMINANT	INSIDE CUES HEAVILY PREDOMINANT
1	2	3	4	5

g. PLEASE EXPAND ON HOW YOU DETERMINE YOUR MANUAL RELEASE POINT IN YOUR AIRCRAFT:

____

____

h. TO WHAT EXTENT ARE YOU USING THE SAME INSIDE/OUTSIDE MIX OF REFERENCES TO DETERMINE RELEASE POINTS IN THIS SIMULATOR AS YOU WOULD IN YOUR AIRCRAFT.

USING INSIDE REFERENCES CONSIDERABLY MORE IN SIMULATOR THAN IN AIRCRAFT	USING INSIDE REFERENCES SLIGHTLY MORE IN SIMULATOR THAN IN AIRCRAFT	SAME AS AIRCRAFT	USING OUTSIDE REFERENCES SLIGHTLY MORE IN SIMULATOR THAN IN AIRCRAFT	USING OUTSIDE REFERENCES CONSIDERED MORE IN SIMULATOR THAN IN AIRCRAFT
1	2	3	4	5

PLEASE COMMENT: ______________________________

____

____

i. RATE THE CAPABILITY OF THE VISUAL SCENE TO PROVIDE ENOUGH DETAILS IN THE BASE LEG AREA SO THAT YOU CAN ADJUST YOUR PATTERN AND COMPENSATE FOR THE WIND EFFECT.

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT: ______________________________

____

____

j. TO WHAT EXTENT ARE YOU ABLE TO USE THE VISUAL SCENE'S FOUL LINE AND SURROUNDING AREA TO DETERMINE YOUR CEASE FIRE RANGE DURING STRAFE AS COMPARED TO A TYPICAL GUNNERY RANGE FOUL LINE: (Mission #3 Only)

SIMULATED FOUL LINE CONSIDERABLY LESS USABLE	SIMULATED FOUL LINE SLIGHTLY LESS USABLE	SAME	SIMULATED FOUL LINE SLIGHTLY MORE USABLE	SIMULATED FOUL LINE CONSIDERABLY MORE USABLE
1	2	3	4	5

PLEASE CONTINUE WITH A REMARK ABOUT THE ADEQUACY OF THE SIMULATED FOUL LINE ______________________________

____

____

k. RATE THE CAPABILITY OF THE VISUAL SCENE TO PROVIDE SUFFICIENT REFERENCES AROUND THE TARGET AREA SO THAT YOU CAN DETERMINE YOUR UPWIND AIM POINT AND KEEP TRACK OF THAT POINT THROUGHOUT THE GUNNERY PATTERN.

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

l. CAN YOU DETERMINE THE POINT TO PLACE THE PIPPER ON ROLLOUT?

EXPLAIN ____

____

____

m. CAN YOU CONTROL THE PIPPER'S RATE OF MOVEMENT ON THE GROUND:

EXPLAIN ____

____

____

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK. PLEASE PROVIDE COMMENTS, GOOD OR BAD, ON ALL TASKS.

	VISUAL SYSTEM CAPABILITY					COULD YOU PERFORM TASK		
TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	YES	NO	MAYBE
BOX PATTERN	1	2	3	4	5	YES	NO	MAYBE

Comment ______________________________

____

ROLL-IN	1	2	3	4	5	YES	NO	MAYBE

Comment ______________________________

____

DIVE ANGLE ESTABLISHMENT	1	2	3	4	5	YES	NO	MAYBE

Comment ______________________________

____

RECOVERY	1	2	3	4	5	YES	NO	MAYBE

Comment ______________________________

____

MISSION #3 TASKS

LEVEL BOMB	1	2	3	4	5	YES	NO	MAYBE

Comment ______________________________

____

LOW ANGLE STRAFE	1	2	3	4	5	YES	NO	MAYBE

Comment ______________________________

____

10° SKIP (BOX)	1	2	3	4	5	YES	NO	MAYBE

COMMENT ______________________________

____

15° LAB	1	2	3	4	5	YES	NO	MAYBE

COMMENT ______________________________

____

TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	COULD YOU PERFORM TASK YES	NO	MAYBE
MISSION #4 TASKS								
30° DB	1	2	3	4	5	YES	NO	MAYBE
Comment								
30° HAS	1	2	3	4	5	YES	NO	MAYBE
Comment								
45°DB	1	2	3	4	5	YES	NO	MAYBE
Comment								
60° DB	1	2	3	4	5	YES	NO	MAYBE
Comment								

PILOT #:
MISSION #:
TIME OF DAY:
DATE:

MISSION DEBRIEFING QUESTIONNAIRE - ASUPT 5 + 6 + 7 + 8

a. MISSION DURATION:

b. UNACCOMPLISHED TASKS:

c. TASKS WHICH YOU WOULD LIKE TO REFLY:

d. NEW TASKS WHICH YOU WOULD LIKE THE OPPORTUNITY TO FLY:

e. RATE THE CAPABILITY OF THE VISUAL SCENE TO PROVIDE SUFFICIENT REFERENCES AROUND THE TARGET AREA SO THAT YOU CAN DETERMINE YOUR BASE LEG, UPWIND AIM POINT, AND KEEP TRACK OF THAT UPWIND AIM POINT THROUGHOUT THE GUNNERY PATTERN.

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT ____

____

____

f. RATE THE OVERALL ADEQUACY OF THE LEAD AIRCRAFT FOR USE IN CLOSE, ROUTE, CROSSUNDER, AND CLOSE TRAIL TASKS.

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT FURTHER PLEASE ____

____

____

g. RATE THE ADEQUACY OF THE GROUND MARKING DEVICE FOR USE IN TARGET IDENTIFICATION:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT ______________________________

____

h. WHEN IN A DELIVERY PATTERN WITH THE LEAD AIRCRAFT, TO WHAT EXTENT WERE YOU ABLE TO KEEP HIM IN SIGHT AND THUS MAINTAIN SPACING AND PROVIDE MUTUAL SUPPORT?

COULD NOT KEEP IN SIGHT	KEPT IN SIGHT OCCASIONALLY	KEPT IN SIGHT HALF OF THE TIME	KEPT IN SIGHT MOST OF THE TIME	KEPT IN SIGHT THROUGHOUT
1	2	3	4	5

PLEASE EXPAND ON THE TWO-SHIP ATTACK PORTION: ______________________________

____

____

i. TO WHAT EXTENT DOES THE REDUCED VISIBILITY ADD REALISM TO TACTICAL AREA OPERATIONS?

ADDS NO REALISM	ADDS MARGINAL REALISM	ADDS GOOD REALISM	ADDS VERY GOOD REALISM	PROVIDES OUTSTANDING REALISM
1	2	3	4	5

COMMENT ______________________________

____

j. TO WHAT EXTENT WAS THE APPLICATION OF THE MOVING MODEL (LEAD AIRCRAFT, FAC) EFFECTIVE ON TODAY'S SORTIE?

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

PROVIDE FURTHER COMMENTS CONCERNING YOUR INVOLVEMENT WITH THE MOVING MOTION

____

____

k. RATE THE CAPABILITY OF THE VISUAL SYSTEM TO MAKE TARGETS DIFFICULT TO IDENTIFY, LOCATE AND ATTACK.

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT ____

____

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK. PLEASE PROVIDE ANSWERS FOR TASKS PERFORMED ON THIS FLIGHT.

TASK TITLE	VISUAL SYSTEM CAPABILITY 1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	COULD YOU PERFORM TASK YES	NO	MAYBE
FORMATION TAKEOFF	1	2	3	4	5	YES	NO	MAYBE
Comment								
FORMATION LANDING	1	2	3	4	5	YES	NO	MAYBE
Comment								
CLOSE, ROUTE, CROSSUNDER	1	2	3	4	5	YES	NO	MAYBE
Comment								
CLOSE TRAIL	1	2	3	4	5	YES	NO	MAYBE
Comment								

	VISUAL SYSTEM CAPABILITY					COULD YOU PERFORM TASK		
TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	YES	NO	MAYBE
EXTENDED TRAIL	1	2	3	4	5	YES	NO	MAYBE
Comment								
TACTICAL FORMATION	1	2	3	4	5	YES	NO	MAYBE
Comment								
RESTRICTED RUN-IN ATTACKS	1	2	3	4	5	YES	NO	MAYBE
Comment								
RANDOM RUN-IN ATTACKS	1	2	3	4	5	YES	NO	MAYBE
Comment								
TACTICAL TARGET REATTACK	1	2	3	4	5	YES	NO	MAYBE
Comment								
TERRAIN MASKING	1	2	3	4	5	YES	NO	MAYBE
Comment								
KEEPING FAC IN SIGHT	1	2	3	4	5	YES	NO	MAYBE
Comment								

TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	YES	NO	MAYBE
	VISUAL SYSTEM CAPABILITY					COULD YOU PERFORM TASK		
LAS	1	2	3	4	5	YES	NO	MAYBE
Comment								
10° SKIP	1	2	3	4	5	YES	NO	MAYBE
Comment								
15° LAB	1	2	3	4	5	YES	NO	MAYBE
Comment								
30° DB	1	2	3	4	5	YES	NO	MAYBE
Comment								
30° HAS	1	2	3	4	5	YES	NO	MAYBE
Comment								
45° DB	1	2	3	4	5	YES	NO	MAYBE
Comment								

PILOT #:
MISSION #:
TIME OF DAY:
DATE:

MISSION DEBRIEFING QUESTIONNAIRE - ASUPT 9

a. MISSION DURATION:

b. UNACCOMPLISHED TASKS:

c. TASKS WHICH YOU WOULD LIKE TO FLY:

d. NEW TASKS WHICH YOU WOULD LIKE THE OPPORTUNITY TO FLY:

e. TO WHAT EXTENT DID YOU FIND THE REINITIALIZATION FEATURE OF THE SIMULATOR HARMFUL OR HELPFUL IN COMPLETING MULTIPLE WEAPONRY PASSES?

VERY HARMFUL	SOMEWHAT HARMFUL	NEITHER HARFUL NOR HELPFUL	SOMEWHAT HELPFUL	VERY HELPFUL
1	2	3	4	5

COMMENT: ______________________________

____

____

f. IN AN ACTUAL AIRCRAFT, RATE THE EXTENT TO WHICH YOU USE OUTSIDE-THE-COCKPIT CUES AS OPPOSED TO INSIDE-THE-COCKPIT CUES TO DETERMINE TIME TO RELEASE ORDNANCE.(NIGHT)

OUTSIDE CUES HEAVILY PREDOMINANT	OUTSIDE CUES SLIGHTLY PREDOMINANT	EVENLY USE INSIDE AND OUTSIDE CUES	INSIDE CUES SLIGHTLY PREDOMINANT	INSIDE CUES HEAVILY PREDOMINANT
1	2	3	4	5

g. PLEASE EXPAND ON HOW YOU DETERMINE YOUR MANUAL RELEASE POINT IN YOUR AIRCRAFT:

____

____

h. TO WHAT EXTENT ARE YOU USING THE SAME INSIDE/OUTSIDE MIX OF REFERENCES TO DETERMINE RELEASE POINTS IN THIS SIMULATOR AS YOU WOULD IN YOUR AIRCRAFT. (NIGHT)

USING INSIDE REFERENCES CONSIDERABLY MORE IN SIMULATOR THAN IN AIRCRAFT	USING INSIDE REFERENCES SLIGHTLY MORE IN SIMULATOR THAN IN AIRCRAFT	SAME AS AIRCRAFT	USING OUTSIDE REFERENCES SLIGHTLY MORE IN SIMULATOR THAN IN AIRCRAFT	USING OUTSIDE REFERENCES CONSIDERED MORE IN SIMULATOR THAN IN AIRCRAFT
1	2	3	4	5

PLEASE COMMENT: ____

____

____

i. RATE THE CAPABILITY OF THE VISUAL SCENE TO PROVIDE ENOUGH DETAILS IN THE BASE LEG AREA SO THAT YOU CAN ADJUST YOUR PATTERN AND COMPENSATE FOR THE WIND EFFECT.(DAY AND NIGHT)

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT: ____

____

____

j. TO WHAT EXTENT ARE YOU ABLE TO USE THE VISUAL SCENE'S FOUL LINE AND SURROUNDING AREA TO DETERMINE YOUR CEASE FIRE RANGE DURING STRAFE AS COMPARED TO A TYPICAL GUNNERY RANGE FOUL LINE: (DAY)

SIMULATED FOUL LINE CONSIDERABLY LESS USABLE	SIMULATED FOUL LINE SLIGHTLY LESS USABLE	SAME	SIMULATED FOUL LINE SLIGHTLY MORE USABLE	SIMULATED FOUL LINE CONSIDERABLY MORE USABLE
1	2	3	4	5

PLEASE CONTINUE WITH A REMARK ABOUT THE ADEQUACY OF THE SIMULATED FOUL LINE ____

____

____

k. RATE THE CAPABILITY OF THE VISUAL SCENE TO PROVIDE SUFFICIENT REFERENCES AROUND THE TARGET AREA SO THAT YOU CAN DETERMINE YOUR UPWIND AIM POINT AND KEEP TRACK OF THAT POINT THROUGHOUT THE GUNNERY PATTERN.

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

l. CAN YOU DETERMINE THE POINT TO PLACE THE PIPPER ON ROLLOUT?

EXPLAIN ____

____

____

m. CAN YOU CONTROL THE PIPPER'S RATE OF MOVEMENT ON THE GROUND:

EXPLAIN ____

____

____

n. Rate the adequacy of the simulated night weaponry range for performing night gennery tasks:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

Please expand on the relationship between the simulated night range and an actual night gennery complex: ______________________________

____

____

____

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK. PLEASE PROVIDE COMMENTS, GOOD OR BAD, ON ALL TASKS.

TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	COULD YOU PERFORM TASK YES	NO	MAYBE
BOX PATTERN (NIGHT)	1	2	3	4	5	YES	NO	MAYBE
Comment								
ROLL-IN (NIGHT)	1	2	3	4	5	YES	NO	MAYBE
Comment								
DIVE ANGLE ESTABLISHMENT (NIGHT)	1	2	3	4	5	YES	NO	MAYBE
Comment								
RECOVERY (NIGHT)	1	2	3	4	5	YES	NO	MAYBE
Comment								
15 LAB(NIGHT)	1	2	3	4	5	YES	NO	MAYBE
Comment								
30 DB(NIGHT)	1	2	3	4	5	YES	NO	MAYBE
Comment								
LAS (DAY)	1	2	3	4	5	YES	NO	MAYBE
COMMENT								
15° LAB(DAY)	1	2	3	4	5	YES	NO	MAYBE
COMMENT								

PILOT #:
TIME OF DAY:
DATE:

MISSION DEBRIEFING QUESTIONNAIRE - ASUPT 10

a. MISSION DURATION

b. UNACCOMPLISHED TASKS:

c. WOULD YOU LIKE TO FLY MORE ASUPT MISSIONS? IF SO, WHAT SPECIFIC TASKS WOULD YOU LIKE TO PERFORM?

---

d. COMPARE THE DETAILED AIRCRAFT USED ON MISSION 10 AND THE PREVIOUSLY DISPLAYED LESS DETAILED AIRCRAFT FOR USE IN FORMATION TASKS:

PLAIN AIRCRAFT CONSIDERABLY BETTER TO USE DURING FORMATION FLIGHT	PLAIN AIRCRAFT SLIGHTLY BETTER FOR USE DURING FORMATION FLIGHT	SAME	DETAILED AIRCRAFT SLIGHTLY BETTER FOR USE DURING FORMATION FLIGHT	DETAILED AIRCRAFT CONSIDERABLY BETTER FOR USE DURING FORMATION FLIGHT
1	2	3	4	5

PLEASE EXPAND YOUR COMMENTS CONCERNING THE DETAILED LEAD AIRCRAFT: ______________

---

e. RATE THE ADEQUACY OF THIS DEVICES VISUAL SYSTEM TO CREATE AND DISPLAY A VISUAL SCENE THAT YOU CAN USE FOR PERFORMING LOW LEVEL NAVIGATION TASKS:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT: ______________________________

---

f. RATE THE ADEQUACY OF THE RUNWAY AS PRESENTED UNDER NIGHT CONDITIONS FOR USE IN PERFORMING NIGHT TRAFFIC PATTERN TASKS:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

Comment: ______________________________

____

ANSWER THE FOLLOWING QUESTIONS WITH REFERENCE TO YOUR COMPLETE EXPERIENCE IN THIS DEVICE AS GAINED FROM THE LAST TEN MISSIONS:

g. RATE THE DEGREE TO WHICH THE FOLLOWING CHARACTERISTICS OF THIS SYSTEM'S METHOD OF CREATING A VISUAL SCENE WAS EITHER DISTRACTING OR NOT DISTRACTING:

	CONSIDERABLY DISTRACTING		MODERATELY DISTRACTING		NO DISTRACTION
	1	2	3	4	5
Seams between windows	1	2	3	4	5

Comment: ______________________________

____

Alignment of visual scene when crossing between windows	1	2	3	4	5

Comment: ______________________________

____

Objects popping in and out	1	2	3	4	5

Comment: ______________________________

____

G-Seat operation	1	2	3	4	5

Comment: ______________________________

____

Motion Operation	1	2	3	4	5

Comment: ______________________________

____

h. IN YOUR OPINION, HOW COULD THIS SIMULATOR'S AIR-TO-GROUND CAPABILITY BE USED IN THE NEAR FUTURE IN TAC?

____

____

____

i. IN YOUR OPINION, DID THE MOTION AFFECT YOUR ABILITY TO PERFORM TASKS ACCURATELY (BOMB, STRAFE, FORMATION, ETC.)?

PERFORMANCE CONSIDERABLY MORE ACCURATE WITH MOTION ON	PERFORMANCE SLIGHTLY BETTER WITH MOTION ON	NO DIFFERENCE MOTION-ON MOTION-OFF	PERFORMANCE SLIGHTLY BETTER WITH MOTION OFF	PERFORMANCE CONSIDERABLY MORE ACCURATE WITH MOTION OFF
1	2	3	4	5

FURTHER EXPANSION CONCERNING MOTION: ______________________________

____

____

j. WHAT IS YOUR GENERAL IMPRESSION OF OPERATING IN A VISUAL SCENE THAT IS CONSTRUCTED WITH LINES, EDGES, SHADES, ETC. ______________________________

____

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK.

VISUAL SYSTEM CAPABILITY

TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	COULD YOU PERFORM TASK YES NO MAYBE
CLOSE FORMATION	1	2	3	4	5	YES NO MAYBE
CLOSE TRAIL	1	2	3	4	5	YES NO MAYBE
LOW LEVEL FLIGHT	1	2	3	4	5	YES NO MAYBE
NIGHT GCA	1	2	3	4	5	YES NO MAYBE

CLOSE FORMATION Comment; ______________________________

____

CLOSE TRAIL Comment: ______________________________

____

LOW LEVEL FLIGHT Comment: ______________________________

____

NIGHT GCA Comment: ______________________________

____

VISUAL SYSTEM CAPABILITY

TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	COULD YOU PERFORM TASK YES	NO	MAYBE
CLOSE FORMATION	1	2	3	4	5	YES	NO	MAYBE
Comment; ______________								
CLOSE TRAIL	1	2	3	4	5	YES	NO	MAYBE
Comment: ______________								
LOW LEVEL FLIGHT	1	2	3	4	5	YES	NO	MAYBE
Comment: ______________								
NIGHT GCA	1	2	3	4	5	YES	NO	MAYBE
Comment: ______________								

Pilot # ____________
Time of Day ________
Date ______________

MISSION DEBRIEFING QUESTIONAIRE ASUPT 11 (refly)

A. Mission Duration: ______________

B. Unaccomplished Tasks: ____

C. Tasks which you would like to refly: ______________________________

D. New tasks which you would like to the opportunity to fly: __________

____

E. Rate the adequacy of the monochrome display as used for presenting images that are clear, detailed, and discernable:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

GENERAL COMMENT ON MONOCHROME PICTURE: ________________________________

____

____

F. To what extent do you think the addition of color would enhance the CIG display imagery? What specific tasks do you think could be performed better if color was added?

COMMENTS: ____

____

____

G. Rate the adequacy of the FOV as used during all task performance:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

What, if any, task performance was limited by the size of the FOV? ___________

____

What do you think will be the limitation when operating with a 120° horizontal by 60° vertical FOV? ____

____

H. Compare the FOV in ASUPT (7 windows) and the FOV in SAAC (8 windows) as used in general task performance:

SAAC FOV CONSIDERABLY BETTER	SAAC FOV SLIGHTLY BETTER	SAME	ASUPT FOV SLIGHTLY BETTER	ASUPT FOV CONSIDERABLY BETTER
1	2	3	4	5

List specific tasks that had to be altered as a result of an FOV restriction in either sytem: ______________________________

____

____

I. Did the horizontal and vertical edges of the objects appear smooth or jagged?

HORIZONTAL SMOOTH / JAGGED

VERTICAL SMOOTH / JAGGED

COMMENT ON THE SMOOTHING: ______________________________

____

____

J. Rate the modeling capability of this 2000 edge system. Could it display enough detail?

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT ON YOUR EXPECTED OPINION OF A 1000 EDGE COLOR ENVIROMENT: ____________

____

____

K. Rate the alignmemt capability of this display system. Does the imagery stay lined up as the picture crosses a seam between two or three CRT's?

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT: ______________________________

____

____

L. Compare ASUPT and SAAC imagery alignment:

SAAC ALIGNMENT CONSIDERABLY BETTER	SAAC ALIGNMENT SLIGHTLY BETTER	SAME	ASUPT ALIGNMENT SLIGHTLY BETTER	ASUPT ALIGNMENT CONSIDERABLY BETTER
1	2	3	4	5

Was any task performance altered as a result of alignment capability in either system? ______________________________

____

____

M. Compare the ability of the SAAC and ASUPT motion systems used to provide realistic motion cues:

SAAC MOTION CONSIDERABLY MORE REALISTIC	SAAC MOTION SLIGHTLY MORE REALISTIC	SAME	ASUPT MOTION SLIGHTLY MORE REALISTIC	ASUPT MOTION CONSIDERABLY MORE REALISTIC
1	2	3	4	5

Was there any task performance that had to be altered due to either motion system? ______________________________

____

____

N. Compare the ability of the SAAC and ASUPT "G"-Seat system as used to provide realistic G cues (DISREGARD G-SUITS)

SAAC "G" SEAT CONSIDERABLY MORE REALISTIC	SAAC "G" SEAT SLIGHTLY MORE REALISTIC	SAME	ASUPT "G" SEAT SLIGHTLY MORE REALISTIC	ASUPT "G" SEAT CONSIDERABLY MORE REALISTIC
1	2	3	4	5

Was there any task performance that had to be altered due to either "G" Seat system? ______________________________

____

____

O. To what extent can you use this simulator's visual scene the same as you would use an actual range scene to perform gunnery tasks?

SIMULATED VISUAL LESS USABLE			SAME	SIMULATED VISUAL MORE USABLE		
1	2	3	4	5	6	7

COMMENT: ____

____

____

P. Rate the capability of the visual scene to provide enough details in the base leg area so that you can adjust your pattern and compensate for the wind effect:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT: ____

____

____

Q. To what extent does the reduced visibility add realism to tactical area operations?

ADDS NO REALISM	ADDS MARGINAL REALISM	ADDS GOOD REALISM	ADDS VERY GOOD REALISM	ADDS OUTSTANDING REALISM
1	2	3	4	5

COMMENT: ____

____

____

R. Rate the capability of this system to obtain a smooth, blended transition between the earth's surface and the horizon.

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

Describe the earth/sky horizon. ____

____

____

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS (1 - 5) AND INDICATE IF YOU COULD PERFORM THE TASK (Yes-No-Maybe):

	INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING	TASK PERFORMANCE		
Takeoff	1	2	3	4	5	Yes	No	Maybe
VFR Overhead	1	2	3	4	5	Yes	No	Maybe
Landing	1	2	3	4	5	Yes	No	Maybe
MVG TGT Attack	1	2	3	4	5	Yes	No	Maybe
15° LAB	1	2	3	4	5	Yes	No	Maybe
LAS	1	2	3	4	5	Yes	No	Maybe
30° DB	1	2	3	4	5	Yes	No	Maybe
Box Pattern	1	2	3	4	5	Yes	No	Maybe
Roll-In	1	2	3	4	5	Yes	No	Maybe
Establish DIVE	1	2	3	4	5	Yes	No	Maybe
Recovery	1	2	3	4	5	Yes	No	Maybe

COMMENTS: ______________________________

PILOT #:
MISSION #:
TIME OF DAY:
DATE:

MISSION DEBRIEFING QUESTIONNAIRE - SAAC/#18-1 and 2

a. MISSION DURATION:

b. UNACCOMPLISHED TASKS:

c. TASKS WHICH YOU WOULD LIKE TO REFLY:

d. NEW TASKS WHICH YOU WOULD LIKE THE OPPORTUNITY TO FLY:

e. TO WHAT EXTENT DO YOU BELIEVE THAT YOU HAVE A BASIC FEEL FOR THIS SIMULATED AIRCRAFTS' FLIGHT DYNAMICS AND CHARACTERISTICS?

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT: ______________________________

____

____

f. DO YOU NEED MORE FAMILIARIZATION TIME BEFORE EVALUATING WEAPONRY TASKS?

g. TO WHAT EXTENT DID YOU USE THE SIMULATED VISUAL SCENE, THE SAME AS YOU USE AN ACTUAL VISUAL SCENE TO PERFORM AIRWORK AND AEROBATIC MANEUVERS? (SAAC/#18-1 only)

	SIMULATED VISUAL LESS USABLE		SAME		SIMULATED VISUAL MORE USABLE	
1	2	3	4	5	6	7

PLEASE EXPLAIN YOUR ANSWER: ______________________________

____

____

h. TO WHAT EXTENT DID YOU USE THE SIMULATED VISUAL SCENE, THE SAME AS YOU USE AN ACTUAL VISUAL SCENE TO PERFORM WEAPONRY TASKS? (SAAC/#18-2 only)

SIMULATED VISUAL LESS USABLE			SAME		SIMULATED VISUAL MORE USABLE	
1	2	3	4	5	6	7

PLEASE EXPLAIN YOUR ANSWER: ______________________________

____

____

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK. PLEASE PROVIDE COMMENTS ON ALL TASKS, EXPECIALLY THOSE RATED 1, 2, OR 3, OR MARKED "NO" OR "MAYBE".

TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	COULD YOU PERFORM TASK YES	NO	MAYBE
Lazy Eight	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Chandelle	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Slow Flight	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Stalls	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Aileron Roll	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Barrel Roll	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK. PLEASE PROVIDE COMMENTS ON ALL TASKS, EXPECIALLY THOSE RATED 1, 2, OR 3, OR MARKED "NO" OR "MAYBE".

VISUAL SYSTEM CAPABILITY

TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	COULD YOU PERFORM TASK YES	NO	MAYBE
[illegible]	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ______________________________

Loop	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ______________________________

Immelman	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ______________________________

Split-S	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ______________________________

Cuban Eight	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ______________________________

Spin	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ______________________________

PILOT #:
MISSION #:
TIME OF DAY:
DATE:

MISSION DEBRIEFING QUESTIONNAIRE - SAAC/#18-2&4 and 4&6

a. MISSION DURATION:

b. UNACCOMPLISHED TASKS:

c. TASKS WHICH YOU WOULD LIKE TO REFLY:

d. NEW TASKS WHICH YOU WOULD LIKE THE OPPORTUNITY TO FLY:

e. IN AN ACTUAL AIRCRAFT, RATE THE EXTENT TO WHICH YOU USE OUTSIDE-THE-COCKPIT CUES AS OPPOSED TO INSIDE-THE-COCKPIT CUES TO DETERMINE THE TIME TO RELEASE ORDNANCE.

OUTSIDE CUES HEAVILY PREDOMINANT	OUTSIDE CUES SLIGHTLY PREDOMINANT	EQUAL USE OF INSIDE AND OUTSIDE CUES	INSIDE CUES SLIGHTLY PREDOMINANT	INSIDE CUES HEAVILY PREDOMINANT
1	2	3	4	5

PLEASE EXPAND ON HOW YOU DETERMINE YOUR MANUAL RELEASE POINT IN YOUR AIRCRAFT: ______________________________

____

____

f. TO WHAT EXTENT ARE YOU USING THE SAME INSIDE/OUTSIDE MIX OF REFERENCES TO DETERMINE RELEASE POINTS IN THIS SIMULATOR AS YOU WOULD IN YOUR AIRCRAFT?

USING INSIDE REFERENCES CONSIDERABLY MORE IN SIMULATOR THAN IN AIRCRAFT	USING INSIDE REFERENCES SLIGHTLY MORE IN SIMULATOR THAN IN AIRCRAFT	SAME AS AIRCRAFT	USING OUTSIDE REFERENCES SLIGHTLY MORE IN SIMULATOR THAN IN AIRCRAFT	USING OUTSIDE REFERENCES CONSIDERABLY MORE IN SIMULATOR THAN IN AIRCRAFT
1	2	3	4	5

PLEASE EXPLAIN YOUR ANSWER: ______________________________

____

____

3. RATE THE ADEQUACY OF THE SIZE OF THE AREA OF INTEREST FOR USE IN PERFORMING AIR-TO-GROUND WEAPONRY TASKS:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

PLEASE COMMENT: ______________________________

____

____

5. RATE THE CAPABILITY OF THE VISUAL SCENE TO PROVIDE ENOUGH DETAILS IN THE RANGE AREA SO THAT YOU CAN ADJUST YOUR PATTERN TO COMPENSATE FOR BEING SHALLOW OR STEEP:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT: ______________________________

____

____

6. RATE THE CAPABILITY OF THE VISUAL SCENE TO PROVIDE SUFFICIENT REFERENCE IN THE TARGET AREA SO THAT YOU CAN DETERMINE YOUR AIM POINT AND KEEP TRACK OF THAT POINT THROUGHOUT THE GUNNERY PATTERN.

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT: ______________________________

____

____

1. RATE THE ADEQUACY OF THE VISUAL SCENE TO PROVIDE ENOUGH DETAILS AROUND THE TARGET SO THAT YOU CAN DETERMINE THE POINT TO PLACE THE PIPPER [illegible] ROLL-OUT [illegible] JUDGE THE PIPPER'S RATE OF MOVEMENT ON THE GROUND THROUGHOUT THE [illegible] DELIVERY:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

EXPAND ANSWERS PLEASE: ____

____

____

[illegible] CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK. PLEASE PROVIDE COMMENTS ON ALL TASKS, ESPECIALLY THOSE RATED 1, 2, OR 3, OR MARKED "NO" OR "MAYBE".

VISUAL SYSTEM CAPABILITY

TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTANDING	COULD YOU PERFORM TASK YES	NO	MAYBE
Box Pattern	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ____________________

Fall-in	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ____________________

[illegible]	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ____________________

Recovery	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ____________________

LAS	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ____________________

[illegible]	1	2	3	4	5	YES	NO	MAYBE

COMMENTS: ____________________

[illegible]

[illegible] OF THE VISUAL SCENE TO SUPPORT PERFO[illegible] [illegible] AND [illegible] IF [illegible] COULD PERFORM THE TASK. [illegible] ALL TASKS, [illegible] THOSE RATED 1, 2, OR 3, OR MARKED "NO" OR "[illegible]"

VISUAL SYSTEM CAPABILITY

TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 [illegible]	[illegible] YES	NO	
[illegible]	1	2	3	4	5	YES	NO	[illegible]

COMMENTS:

[illegible]	1	2	3	4	5	YES	NO	[illegible]

COMMENTS:

Straight-In	1	2	3	4	5	YES	NO	[illegible]

COMMENTS:

[illegible] Overhead	1	2	3	4	5	YES	NO	[illegible]

COMMENTS:

Glide Path Control	1	2	3	4	5	YES	NO	[illegible]

COMMENTS:

Closed	1	2	3	4	5	YES	NO	[illegible]

COMMENTS:

[illegible] THE CAPABILITY OF [illegible] VISUAL SCENE TO SUPPORT [illegible] [illegible] TASKS AND [illegible] IF YOU COULD PERFORM THE TASK. [illegible] [illegible] TASKS, ESPECIALLY THOSE RATED 1, 2, OR 3, OR MARKED [illegible] OR [illegible].

VISUAL SYSTEM CAPABILITY

TASK TITLE	1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	[illegible] 5 OUTSTANDING	[illegible] YES NO [illegible]
Go Around	1	2	3	4	5	YES NO [illegible]

COMMENTS:

Recovery	1	2	3	4	5	YES NO [illegible]

COMMENTS:

	1	2	3	4	5	YES NO [illegible]

COMMENTS:

	1	2	3	4	5	YES NO [illegible]

COMMENTS:

	1	2	3	4	5	YES NO [illegible]

COMMENTS:

	1	2	3	4	5	YES NO [illegible]

COMMENTS:

PILOT #:
MISSION #:
TIME OF DAY:
DATE:

MISSION DEBRIEFING QUESTIONNAIRE - LAMARS 5/6

a. MISSION DURATION:

b. UNACCOMPLISHED TASKS:

c. TASKS WHICH YOU WOULD LIKE TO REFLY:

d. NEW TASKS WHICH YOU WOULD LIKE THE OPPORTUNITY TO FLY:

e. TO WHAT EXTENT DOES THE REDUCED VISIBILITY ADD REALISM TO TACTICAL AREA OPERATIONS? (LAMARS 6 ONLY)

ADDS NO REALISM	ADDS MARGINAL REALISM	ADDS GOOD REALISM	ADDS VERY GOOD REALISM	PROVIDES OUTSTANDING REALISM
1	2	3	4	5

COMMENT: ____________________

____

____

f. RATE THE CAPABILITY OF THE VISUAL SYSTEM TO MAKE TARGETS DIFFICULT TO IDENTIFY, LOCATE, AND ATTACK:

INADEQUATE	MARGINAL	GOOD	VERY GOOD	OUTSTANDING
1	2	3	4	5

COMMENT: ____________________

____

____

8. COMPARE HEAD-SLAVED AND TARGET-SLAVED AOI CONTROL FOR USE IN WEAPONRY TASKS.

HEAD SLAVED CONSIDERABLY BETTER THAN TARGET SLAVED	HEAD SLAVED SLIGHTLY BETTER THAN TARGET SLAVED	NO DIFFERENCE	TARGET SLAVED SLIGHTLY BETTER THAN HEAD SLAVED	TARGET SLAVED CONSIDERABLY BETTER THAN HEAD SLAVED
1	2	3	4	5

PLEASE COMMENT: ____

____

____

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK. PLEASE PROVIDE COMMENTS ON ALL TASKS, EXPECIALLY THOSE RATED 1, 2, OR 3, OR MARKED "NO" OR "MAYBE".

TASK TITLE	VISUAL SYSTEM CAPABILITY 1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	COULD YOU PERFORM TASK YES	NO	MAYBE
Armed Recce	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Locate Target	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Identify Target	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Restricted Pattern	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Random Pattern	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Pop-up Pattern	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								

MDQ - LAMARS 6 (Cont.)

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK. PLEASE PROVIDE COMMENTS ON ALL TASKS, EXPECIALLY THOSE RATED 1, 2, OR 3, OR MARKED "NO" OR "MAYBE".

TASK TITLE	VISUAL SYSTEM CAPABILITY: 1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	COULD YOU PERFORM TASK: YES	NO	MAYBE
Box Pattern	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Roll-in	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Establish Dive Angle	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Recovery	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
Reattack	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
30° DB	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								

RATE THE CAPABILITY OF THE VISUAL SCENE TO SUPPORT PERFORMANCE OF THE FOLLOWING TASKS AND INDICATE IF YOU COULD PERFORM THE TASK. PLEASE PROVIDE COMMENTS ON ALL TASKS, EXPECIALLY THOSE RATED 1, 2, OR 3, OR MARKED "NO" OR "MAYBE".

TASK TITLE	VISUAL SYSTEM CAPABILITY: 1 INADEQUATE	MARGINAL 2	3 GOOD	VERY GOOD 4	5 OUTSTDG	COULD YOU PERFORM TASK: YES	NO	MAYBE
45^{o} DB	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
45^{o} HADB	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
HAS	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								
	1	2	3	4	5	YES	NO	MAYBE
COMMENTS:								

MISSION DEBRIEFING QUESTIONNAIRE- GENERAL

ASUPT LAMARS SAAC #18 DAY NIGHT

NOTE: Feel free to change your response to these questions from one day to the next in light of your increasing experience with the device.

1. DID YOU EXPERIENCE ANY PHYSIOLOGICAL EFFECTS, SUCH AS HEADACHE, EYE-STRAIN, FATIGUE, NAUSEA, OR VERTIGO, ON THIS MISSION?

Please Explain: ____________________

____

2. DID THE VISUAL SCENE MOVEMENT AND THE AIRCRAFT MOVEMENT (VIA THE MOTION BASE INPUT) APPEAR CORRELATED IN DIRECTION AND RATE OF CHANGE THROUGHOUT THIS MISSION?

Elaborate: ____________________

____

3. DID THE G-SEAT AND/OR G-SUIT MOVEMENT AGREE WITH OTHER MOTION CUES AS OBTAINED FROM THE MOTION BASE OR VISUAL SCENE DURING THIS MISSION?

Explain: ____________________

____

4. THROUGH YOUR ASSOCIATION WITH THE SIMULATOR DURING THIS MISSION, CAN YOU IDENTIFY ANY OPERATING CONDITIONS OR CONTINGENCIES THAT COULD RESULT IN THE DEVELOPMENT OF A GROUND HAZARD? (Limit your comments to specifics which have not previously been discussed during the initial ground safety briefing:)

Comments: ____________________

____

5. DURING THIS MISSION, DID YOU RECOGNIZE ANY SIMULATOR CHARACTERISTICS THAT COULD ALLOW YOU TO PERFORM A MANEUVER WHICH, IF SUBSEQUENTLY PERFORMED INFLIGHT, MIGHT PRODUCE AN INFLIGHT HAZARD?

Comment: ____________________

____

PILOT: __________ BRIEFER: __________ MISSION: ___ ___

QUESTIONS 6-13:

RECALLING THAT "REAL WORLD" FLIGHT RELIES ON OUTSIDE THE COCKPIT INDICATIONS (VISUAL SCENE) AND INSIDE THE COCKPIT INDICATIONS (INSTRUMENTS), RATE THE VISUAL SCENE WITH REFERENCE TO THE TASKS FLOWN ON THIS MISSION (i.e., RATE these areas as they pertain to the visual scene, but don't forget that you normally supplement outside glances with inside crosschecks.)

RATING SCALE:	INADEQUATE 1	2 MARGINAL	GOOD 3	VERY GOOD 4	5 OUTSTANDING

6. HOW WELL DOES THE VISUAL SCENE ALLOW YOU TO ATTAIN THE CORRECT AIRCRAFT ATTITUDE:

   1 2 3 4 5

   Explain: ______________________________

   ____

7. HOW WELL DOES THE VISUAL SCENE PROVIDE A RELATIVE SENSE OF SPEED WHEN NEAR TO THE GROUND?

   1 2 3 4 5

   Comment: ______________________________

   ____

8. HOW WELL DOES THE VISUAL PRESENTATION ALLOW YOU TO KEEP TRACK OF YOUR AIRCRAFT'S LOCATION IN THE VISUAL ENVIRONMENT?

   1 2 3 4 5

   Comment: ______________________________

   ____

9. WHEN BELOW 10,000 FEET AGL, HOW WELL DOES THE VISUAL PICTURE PROVIDE YOU WITH A RELATIVE INDICATION OF YOUR ALTITUDE ABOVE GROUND. Remember that you cannot determine your altitude precisely in actual flight from outside references alone.

   1 2 3 4 5

   Expand: ______________________________

   ____

RATING SCALE:	INADEQUATE 1	2 MARGINAL	GOOD 3	VERY GOOD 4	5 OUTSTANDING

10. HOW WELL DOES THE VISUAL SCENE ALLOW YOU TO ADEQUATELY BECOME ALIGNED WITH A TARGET, RUNWAY, OR ANY OBJECT, TO PERFORM AN APPROPRIATE TASK:

1 2 3 4 5

Comment: ____________________

11. HOW WELL DOES THE VISUAL SCENE ALLOW YOU TO DETERMINE YOUR ALTITUDE RATE OF CHANGE?

1 2 3 4 5

Explain: ____________________

12. HOW WELL DOES THE VISUAL SCENE ALLOW YOU TO DETERMINE YOUR RATE OF CHANGE IN SPEED?

1 2 3 4 5

Comment: ____________________

13. HOW WELL DOES THE VISUAL SCENE ALLOW YOU TO DETERMINE YOUR RATE OF ATTITUDE CHANGE?

1 2 3 4 5

Comment: ____________________

QUESTIONS 14-18

CONSIDER THE TASKS FLOWN ON THIS MISSION AND RATE THE FOLLOWING CHARACTERISTICS OF THE VISUAL SYSTEM:

RATING SCALE:	INADEQUATE 1	2 MARGINAL	3 GOOD	VERY GOOD 4	5 OUTSTANDING
14. ADEQUACY OF THE FIELD OF VIEW	1	2	3	4	5
Comment:					
15. ADEQUACY OF THE AREA OF INTEREST (N/A ASUPT)	1	2	3	4	5
Comment:					
16. ALIGNMENT OF THE VISUAL SCENE	1	2	3	4	5
Comment:					
17. OVERALL CONTENT IN THE VISUAL SCENE	1	2	3	4	5
Comment:					
18. OVERALL RESOLUTION/ CLARITY OF SPECIFIC ITEMS DURING CLEAR VISIBILITY OPERATIONS	1	2	3	4	5
Comment:					

19. DURING THIS MISSION, DID YOU RECOGNIZE ANY ITEMS, OBJECTS, FEATURES, OR AREAS THAT CONTAINED EXCESSIVE CLARITY OR DETAIL AND WERE, THEREFORE, TOO EASILY IDENTIFIABLE OR TOO CLEARLY DISCERNIBLE?

Please Explain: ______________________________

____

20. WHAT OTHER OBSERVATIONS OR COMMENTS DO YOU HAVE PERTAINING TO TODAY'S MISSION OR THIS SIMULATOR'S VISUAL SYSTEM?

____

____

____